

CONFIDENTIAL REPORTS

TO THE

HON. SIR CHARLES TUPPER, K.C.M.G., C.B.,

Minister of Railways and Canals,

ON THE

HYDRAULIC POWERS

SITUATED UPON THE

ST. LAWRENCE AND WELLAND CANALS

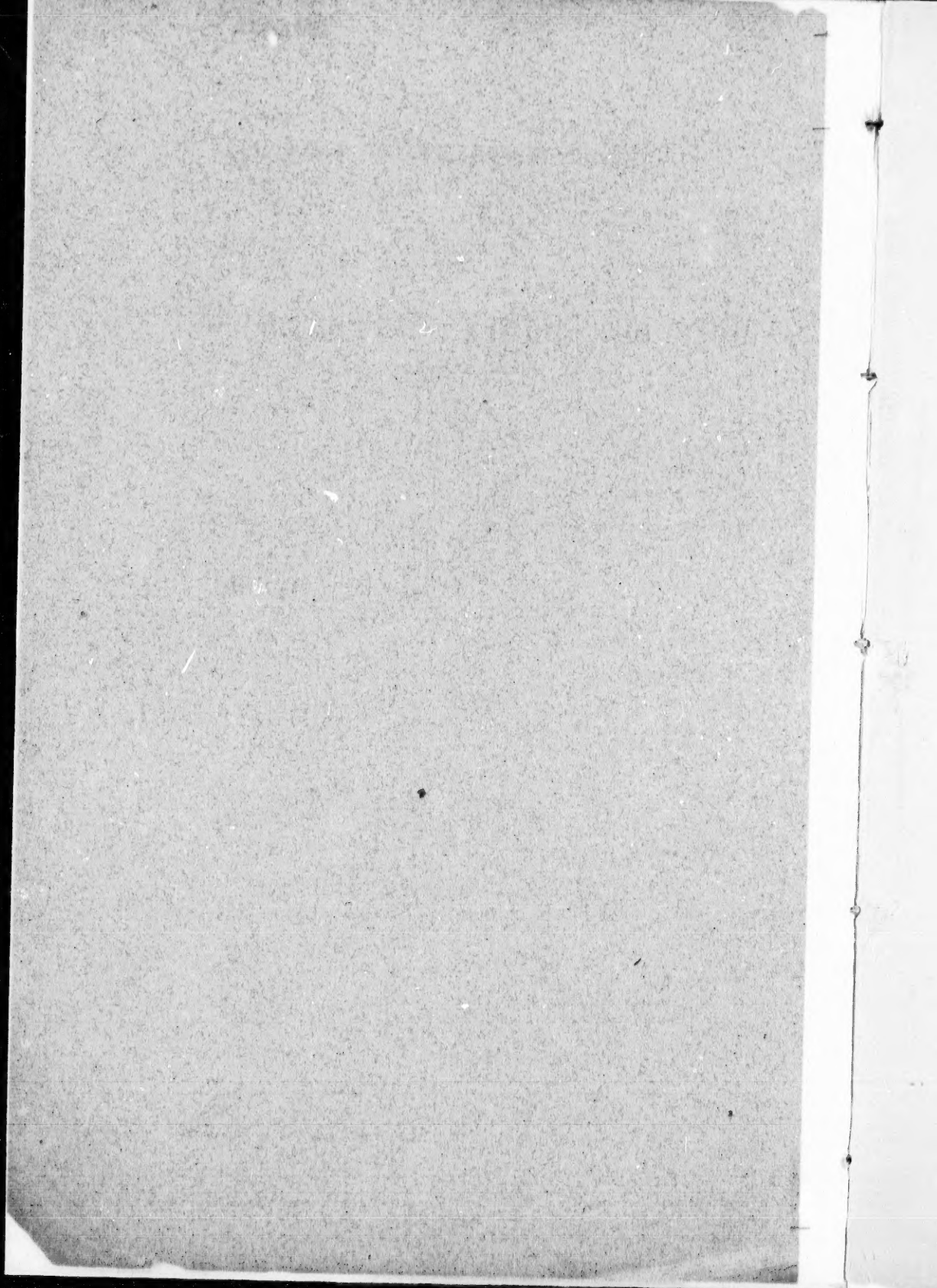
BY

ROBERT C. DOUGLAS,

Assistant Engineer, Railways and Canals.

OTTAWA:

Printed by MACLEAN, ROGER & Co., Wellington Street
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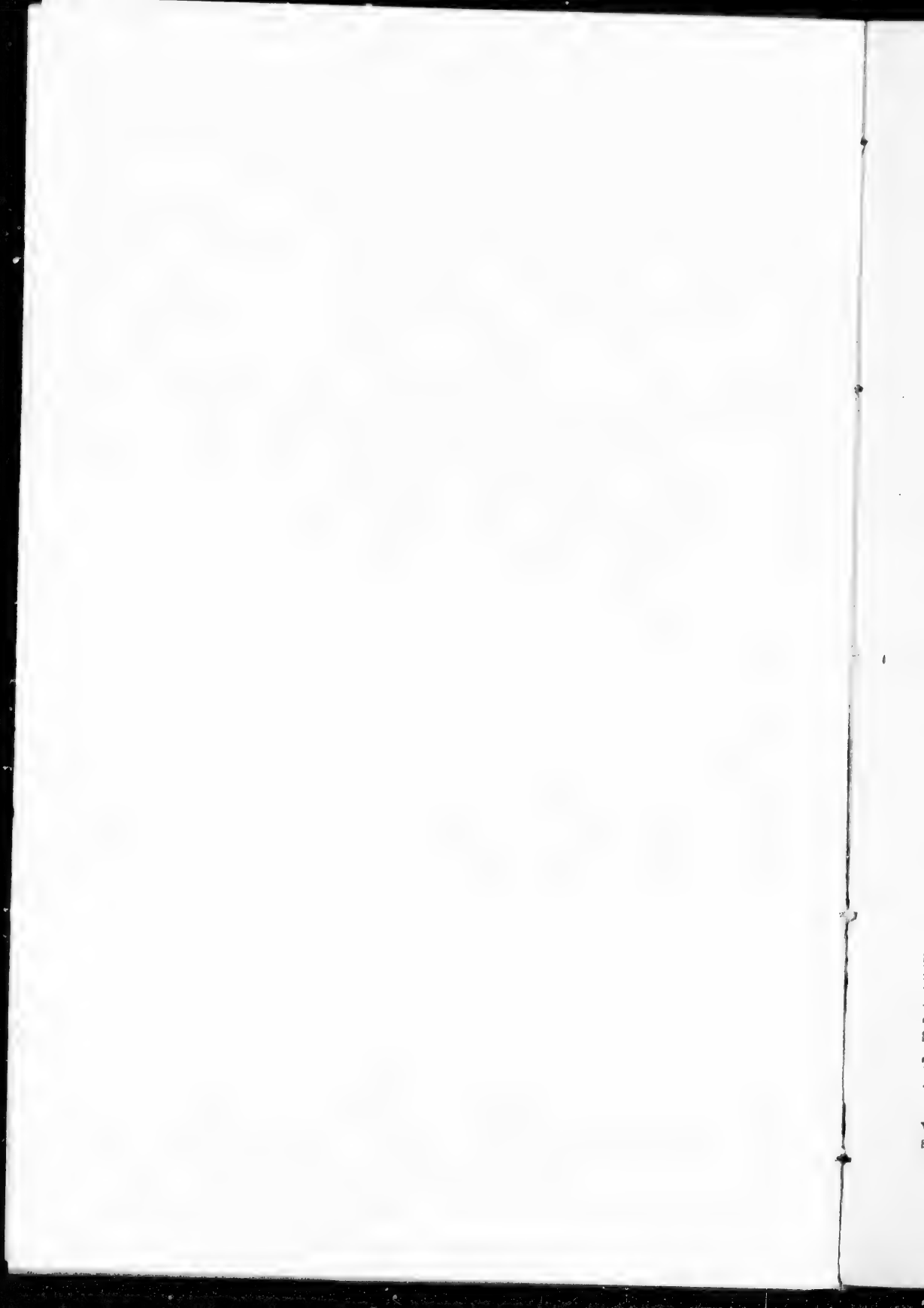
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OTTAWA, 29th April, 1882.

Sir CHARLES TUPPER, C.B., K.C.M.G.,
Minister of Railways and Canals,
Ottawa.

Sir:—

According to your instructions I have made an examination of the systems of leasing water for power, adopted by various water-power companies in the Eastern States, U.S.

I visited four cities, whose growth and manufacturing importance are the result of the development of their water powers.

Before dealing with the more immediate objects of this report, the following statistics will not be foreign to the subject, and will illustrate the advantages of favorably situated water-power to establish centres of industry, to induce large investments of capital, and the training and employment of skilled labor.

In Lowell, Mass., one of the chief cities in the manufacture of cotton, the first water wheel was erected in 1823.

The first works constructed gave some 3,300 horse-powers; by various improvements completed in 1846 this power was increased to its full extent—nearly 10,000 horse-powers. It has at present exceeded its water power by some 15,000 horse-powers, which are supplied by steam.

The following comparative statistics, the first published in 1835, will show the great increase in manufactured products in forty-six years.

Comparative Statistics.	1835.	1881.
Capital stock.....	6,650,000	17,300,000
Number of mills besides appendant buildings.....	22	153
Spindles.....	116,804	806,000
Looms.....	3,933	20,521
Females employed.....	5,051	12,809
Males do.....	1,512	9,750
Yards made per year of cotton.....	38,857,040	209,056,000
do do woollen.....	312,000	8,335,000
do do carpeting.....		2,700,000
Shawls made per year.....		350,000
Hosiery, pairs made per year.....		13,695,520
Pounds, cotton used per year.....	12,256,400	68,173,984
do clean wool do.....	470,000	11,750,000
Yards dyed and printed per annum.....		97,240,000
Tons of anthracite coal used per annum.....		80,000
Steam-power (445 boilers).....		19,793
do (121 engines).....		14,990
Turbine, diameter 2 ft. to 10 ft.....		80

The yearly products manufactured in 1881, reduced to ordinary cottons and woollens one yard wide, are about 130,000 miles in length, or 47,272 acres—i.e. 78·8 square miles, which is nearly seven times the area of Lowell.

These industries give employment to nearly 22,559 operatives, in a population of 64,000.

Lawrence, Mass.—The site of this town was, in 1845, a sand bank; it now has a population of 40,000, of whom 12,000 are engaged in the various manufactures.

Capital invested	\$8,550,000
Spindles.....	No. 346,000
Looms	" 10,000
Yards of cloth produced annually.....	" 100,000,000

Holyoke, Mass.—Started in 1849; the principal product is paper, amounting to some 150 tons daily. There are also many large miscellaneous industries.

Lewiston, Me.—Operations were begun about 1850.

Capital invested	\$7,200,000
Spindles.....	No. 291,806
Yards of cloth produced annually	" 55,000,000

Similar statistics could be cited of many other cities, the above coming more particularly under observation the importance of the power, and the magnitude of the manufactures, it has created, were impressed.

It is said that American statistics show that a population of 5,000 people follow 1,000 horse powers engaged in the manufacture of cotton.

These water-powers were created expressly for power, and by the expenditure of private capital, in contradistinction to those on the Canadian canals, which having been constructed for navigation, the water powers are auxiliary and subsidiary.

The companies generally included mill-sites and water-power. A company being formed with the amount of capital stock required, land was purchased adjacent to a favorable fall, or rapid, the lakes that acted as reservoirs for the river purchased, the dams, canals, and other works necessary to render the fall available for power, and the supply of water continuous, were constructed; the land and water-power were sold together.

The magnitude of the works required may be shown by a brief description of the Holyoke Water-Power, one of the principal powers in the United States.

The Company was incorporated with a capital of \$4,000,000; they purchased 1,200 acres of land adjacent to the falls and rapids at South Hadly, Mass., these extended for a distance of two miles, with a total fall of sixty feet; at their head was built a dam of timber, filled with stone and gravel, over one thousand feet in length, and ninety feet wide at the base, with an average height of thirty feet. This dam contains 4,000,000 feet of timber. The abutments and bulkheads on each side are of masonry. Through the wearing away and undermining of the rock by the quantity of water falling over the dam, its stability was endangered. This cavity was filled with timber and stone, and an apron, extending from the top of the dam to some distance down stream, was constructed at a cost of \$260,000.

The masonry bulkhead is one hundred and forty feet long and forty-six feet wide; upon it is built a gate house containing the machinery for operating the gates, twelve in number, fifteen feet high, twelve feet wide, and weighing four tons each; these are raised and lowered by water-power.

The total fall or head of sixty feet is divided, into two falls of twenty and twelve feet, and one fall varying from twenty to twenty-eight feet, according to the height of water in the river, by three canals, some four miles in length; between the different canals and the river the mills are situated. At each level, watchmen are stationed at overfalls or waste weirs, who keep the levels uniform, exclusive of the water passing through the races of the mills. These levels are never allowed to vary over an inch from the established height of a canal.

The bulkheads, gates, and the general equipments of the canals do not vary much among the principal Companies.

The main dam is frequently built of solid masonry; all the works are of the most improved description; the result of skilful engineering and practical ability.

The power created and utilized, or ready to be made use of, amounts to 30,000 horse-powers in Holyoke; in Lowell, 10,000 horse-powers; in Lawrence, 10,000 horse-powers; in Lewiston, 7,500 horse-powers.

The method of leasing water varies, in the older established companies, the unit of measurement is termed a "mill power," to those unacquainted with its origin, it is more indefinite than our term "run of stones," with this exception, that, their leases define the amount of water under a stated head for each "mill power," a serious omission in the leases of water-power on the Canadian canals.

The article, in the leases, defining the mill power, is virtually the same in the leases of all the companies, using that standard and reads: "Each mill power is declared to be the right, to draw from nearest canal or water course of the grantors, and through the land to be granted so much water as shall give a power equal to —cubic feet per second, when the head and fall is—feet, and no more is to be drawn in any second."

The number of cubic feet of water, and head, or fall, vary according to circumstances, but always represent the same amount of power.

The origin of the term "mill power" is quoted from Webber's "Manuel of Power." The second mill built at Waltham contained 3,584 spindles, with all the apparatus necessary to spin No. 14 yarn and convert it into cloth, which was taken as a standard, and the necessary water-power was estimated and established as the right to draw twenty-five cubic feet per second, on a fall of thirty feet, or a gross horse-power of 85.05, supposed to net about 60-horse power. The price for this was fixed at Lowell, at \$4.00 per spindle, or \$14,336 for a mill power and the necessary land, of which \$5,000 were to remain unpaid, subject to an annual rent of \$300 or \$5.00 per horse-power.

At Lewiston, to avoid any misconception, a lease reads "to draw so much water to give—horse-powers, such horse-powers to be 75 per cent. of the theoretical power of the water, equal to—mill powers, or—cubic feet under a head or fall of—feet.

The Turner's Fall's Co., the unit is—cubic feet per minute.

The Ousatic Water-Power Co., the unit is a square foot, and a defined amount of water, viz.:—"Each square foot to be drawn under and by virtue of this lease shall consist of, and be, five cubic feet of water per second, and no more."

From these quotations, it is evident, there could not be any misconception of the amount of water that lessees would be entitled to use, the absence of this most elementary precision in the leases of water-power upon the Canadian canals has caused no little difficulty.

Surplus Water.—When the demand for increased production required the enlargement of the mills, and more power was required than granted under the permanent leases, or when by improvements the supply of water was increased, above the amount guaranteed in the original leases, it was called surplus water.

Rules, and regulations, governing the use of this water were drawn up with equal stringency to the original leases, and charged for at different rates.

It will be observed that many of these quotations might be applied to the Canadian canals. In the following a few changes adapted to the circumstances would render it directly applicable:—

"And whereas by reason of the removal of obstructions (enlargement) in the River Merrimack (of the canals) and other improvements made by the said proprietors (Government), the number of mill-powers, or privileges, has been greatly increased. And whereas the said lessees have been for some time past, and are now, using more water than by the terms of the several grants made to them aforesaid, they have the right to use, but without any claim of right thereto." This increased

supply was called surplus water; a higher price had to be paid for it, as the power became more valuable than at the date of the original leases.

The use of this surplus water was allowed upon the express condition that the Engineer of the Company should have "all reasonable facilities for ascertaining the quantities used"

One company has two different leases, one for "permanent water," the other "surplus water." The first is the amount flowing at lowest water in river, and subject to no fluctuation; the second, the amount flowing, the river will supply over the defined amount leased as permanent water. The lessees of surplus water, having secondary interests, are charged at less rates for their power. The term surplus water is not in this case synonymous.

The interests of the Water-Power Companies, and the mills using their power, are to a great extent identical. Upon the Canadian canals there are two interests; navigation, and the mills. The leases, in the first case, between parties with mutual interests, are exact, definite, and the stipulations stringent. The leases in the second case, where navigation with opposing interests requires to be protected, are loose and indefinite.

Water is prevented from being wasted by an especial article in the leases which reads: "The grantees are not to use more water than is granted, nor permit it to be wasted for want of repairs, or through the deficiency of their works or otherwise; and if so wasted or more used than granted, the grantors may stop the water from entering the flumes by closing the gates across them, or by any other method, until such waste or excessive use may be sufficiently guarded against, and may at the same time have their action at law for damages; and other grantees who shall suffer thereby may also have their action at law for damages."

These leases provide for the measurement of water. The clause reads:—"For the purpose of ascertaining the quantity of water drawn from the canal of the lessor by the lessee, or permitted to run through the head gates of the lessee, at any time, the lessor reserves the right to construct and maintain any weir, gauge or device of measurement which said lessor shall adopt, and have access to the premises of said lessee by the duly authorized agent, engineer, or other officer of the lessor, and with the necessary workmen and assistants proper for the measuring or ascertaining of the quantity of water drawn or permitted to flow by said lessee."

There has been considerable attention paid to the measuring of water in Europe and India by scientific men. Various appliances have been designed; they are generally called modules, and adapted to measuring small quantities of water, principally upon irrigation canals. None that I am aware of would measure and regulate the large amount of water supplied to mills.

In the United States, Mr. Francis, the distinguished hydraulic engineer, has made an elaborate series of experiments, to determine accurate methods for measuring the volume of water flowing to the various mills, upon the canals of the Water-Power Company, of which he is engineer. Upon these experiments, with others that become necessary in the exercise of his profession, he has expended nearly \$100,000. The results obtained have been published by Mr. Francis in a work entitled "Lowell Hydraulic Experiments."

I may here acknowledge my indebtedness to that gentleman, and his assistant engineer Colonel Francis, for valuable information.

Weir Measurement.—There have been many experiments to determine the discharge of water over a weir, and numerous formulæ deduced. Those of Mr. Francis were upon a large scale and under many conditions. His formulæ are used throughout America by those employed in the measurement of the flow of water. This method of measuring the consumption of water is the simplest, when applicable.

Measurement by the water wheels.—The discharge of the wheel, having been determined under various conditions, it becomes a module. In Holyoke, this is the chief method of gauging the water used by the mills.

A wheel, which has been erected and its discharge unknown, a weir is placed in the tail race, and its discharge, under different openings of speed gate, determined. A new wheel, before it is put in place, is taken to the testing flume, and its discharge ascertained.

Mr. Herschel, the Engineer of the Holyoke Water-Power Co. is at present erecting a new testing flume, fitted up with all the appliances necessary to determine the discharge, efficiency, and other data connected with turbines.

The practical operation of this method will show, that, in the present state of these matters upon the Canadian Canals, it is not applicable, as experienced officers would be required, nor are the mills built in that perfect manner to render it practicable.

An inspector visits the mills, several times, during the hours they are at work. There is a printed form in which his observations are to be entered. The level of water upon the gauges, in the upper and lower canal, between which the mills are situated, is first noted.

In the room containing the machinery controlling the wheel, there is a glass tube graduated to one hundredths of a foot, connected by a pipe with the water in the forebay, the reading of the level of water in this tube, is the height above the wheel. Near the wheel pit, is another gauge connected with it by a pipe which gives the level of water in the wheel pit, the difference between these two readings is the head, or fall, acting upon the wheel.

An indicator showing the distance the gate, admitting the water upon the wheels, is opened, is then read.

The discharge of the wheel, under different conditions, as previously stated, being known, a diagram has been prepared which shows by inspection the consumption of water, when the inspector's returns are sent in.

Every wheel in a mill has its diagram, with a number or letter by which the wheel is known, and the name of the mill upon it.

In the accounts rendered to the mills they have to pay for the power, not calculated from the water vented, and the head acting upon the wheel, but the head or fall between the upper and lower canals. This is done to prevent the mills constructing, or at least they will suffer from, badly designed or ill-proportioned races, penstocks, &c., causing loss of head.

It is evident that a system of this kind is inapplicable to the rude and slovenly state of things upon the Canadian Canals.

Measurement by Gauging Flumes.—A full account, of the origin, and the experiments necessary to secure accurate data for this method, is published in "Lowell Hydraulic Experiments," from which the following information has been obtained.

Three prominent Hydraulic Engineers were appointed in 1841, to ascertain the amount of water consumed by the different corporations at Lowell. They enlarged a section of the canal whose flow was to be determined, and formed a basin with a smaller depth of water, so that a system of paddle wheels used first in 1830, for measuring water, might be adopted. These wheels were erected upon piers across the basin, accurately fitted to the bottom and sides, and revolved together. The quantity of water that was contained between the float boards computed, and the number of revolutions of the wheels, in a given time, noted, the discharge of the canal was easily determined.

As this method was temporary, and too expensive to erect each time the water passing through a canal had to be ascertained, rectangular canals lined with wood were constructed at certain places. The ratio of the mean to the maximum velocity of each canal was found by the means of these wheels, and a coefficient established for each flume.

Mr. Francis on becoming Engineer of the Company, found this method not sufficiently accurate, especially, when certain disturbing influences acted upon the flow of water. A series of experiments were undertaken, to determine the accuracy of computing the amount of water flowing through rectangular canals, from the mean velocity ascertained by the time of transit, through the flume, of a loaded tube, extending nearly to the bottom, and tested at frequent intervals in its cross section from side to side. The discharge of the canal was found by wier measurement, formulae of correction were determined, the use of which showed, that, in rectangular canals lined with plank and smoothly planed, the amount of water passing could be ascertained within two per cent. by these gauging tubes.

The practical working of this system is fully described in "Lowell Hydraulic Experiments."

Mr. Mills, Engineer of the Essex Water Power Co., has made numerous experiments upon piezometers or Pitot tubes; the results of his experiments have not as yet been fully published. He uses them principally to ascertain the amount of water flowing through cylindrical iron pipes, which would be difficult to determine otherwise. Mr. Mills has constructed a number of measuring flumes in the tail races of the mills; this system of measurement is adopted where practicable.

Mr. Herschel, at Holyoke, intends using a current metre of his own invention for ascertaining velocities and measuring the amount of water used.

To both of these gentlemen I am indebted for valuable information.

The application of these methods involves considerable expense, but the results obtained would compensate for the outlay.

At Lewiston it cost \$20,000 to measure the quantity of water consumed by the mills; they were found to be using 70 per cent. more than they were entitled to; it gave an increased revenue to the Water-Power Co. of \$20,000 per year.

With the older companies it has been shown that the cost per annum of a horse-power was \$5.00 to the original grantees. This is no index to the value of power at present, as the land and power were sold together, and a certain portion of the purchase money was retained, bearing interest, which was intended for the perpetual maintenance and operation of the works necessary for supplying the power without trouble or care to the mills using it.

The present value of power is determined by the cost of "surplus water" in the older companies, and what is actually charged in the later at the present time.

The following table shows these charges:—

	Horse-power per year.
Lowell, Mass., surplus water up to 40 per cent. lessees are entitled to use.....	\$23 25
Lawrence, surplus water up to 20 per cent. lessees are entitled to use.....	18 50
Holyoke, surplus water up to 50 per cent. lessees are entitled to use.....	14 00
Lewiston, current value.....	12 50
Turner's Falls do	10 00
Ousatonic do	26 50
Westfield Power Co., steam and water.....	50 00

The average of the first six companies, gives say \$17.50 for water-power in different parts of the Eastern States.

As before stated, the Ousatonic terms of lease correspond more nearly with our circumstances, if instead of what is termed "permanent water," we substitute water for navigation, and for surplus water, the water supplied to the mills, subject to the exigencies of navigation and liable to be shut off for a week or two in the year. This Company considers the value of their surplus water 60 per cent. of the permanent, that would give \$10.50 per horse-power per year for water-power similar to that leased upon the Canadian canals.

On the canals, lessees are permitted to use water during the whole twenty-four hours, but with the above companies they are allowed to draw water a specified time, varying from twelve to sixteen hours. All water used outside these hours has to be paid for.

In Holyoke, where there are a number of paper mills which run all night, there are regulations, and a tariff for water used at night.

This fact increases the value of our power to any mills which run during the whole twenty-four hours.

Steam power.—It is thought in the United States that the average cost of steam power, for manufacturing purposes, is, at least, seven times the cost of water-power.

The average consumption of coal per horse-power per annum, for engines in Canada cannot be determined. Engine and boiler-makers endeavor to bring this consumption below three pounds per hour. I was shown engines in Montreal which were said to consume 2.19 lbs. per hour, a statement which is open to doubt. If we take three pounds per hour, which is below the average, an engine working say 10 hours per day for 300 days, would give $4\frac{1}{2}$ tons per horse-power a year; at \$5 per ton, it will cost \$22.50 a year per horse-power for fuel, without reference to the greater working expenses in using steam, and the larger amount of capital required for engines, boilers, &c., than for water wheels, and the works necessary to conduct the water to them from our canals.

In a table published in a "Treatise on Water-supply Engineering," J. T. Fanning, C.E., the cost is given of raising 1,000,000 gallons 100 feet high, both by steam and water power, at different pumping stations. Take an average of twenty-four using steam the cost amounts to \$10.87. An average of four stations using water-power gives \$2.24 for raising the same amount of water.

At the Montreal Water Works, water is pumped from the same reservoir by both steam and water-power.

Mr. LeSage, in his Report for 1880, gives the average cost for six years of pumping one million gallons one foot high by steam \$0.126, by water \$0.0136.

As there are a number of mills engaged in the manufacture of cotton, upon the Canals, the comparative economy of these two powers may be considered. Mr. Webber, an Engineer, who has had great experience in the machinery and different matters connected with the manufacture of cotton, states in his "Manual of Power," a work from which I have taken the following statistics:—"The transfer of commerce to the Cities of New York and Boston had seriously crippled the prosperity of Newbury Port, Salem, and other towns along the coast of New England, and it was hoped that the institution of manufactures would aid in restoring them to their former prosperity. These towns contained a large unemployed female population, and it was believed that the abundance of labor, and the saving in freight of coal and cotton, would compensate for the additional cost of steam power over that of water; but these hopes have proved fallacious, so far as all the steam mills on the sea coast north-east of Boston are concerned."

Mr. Webber made a careful examination of the cost of power, at four steam mills. Taking the actual running accounts of mill in ordinary years, the average cost of the four mills for fuel, oil, labor, &c., per annum for a horse-power was \$50.04, or with interest and depreciation on plant at \$20.00, gave "a total cost for steam power of \$70.00 per annum, which may be assumed as the average cost in quantities of from 2 to 500 horse-power, near the sea coast of New England."

In this estimate \$100 is taken as a fair average cost per horse-power for engine, boilers and setting, engine house and chimney.

Engine would cost one-third, depreciation 10 per cent.		
Boilers " " " "	20	"
Buildings and chimneys one-third "	6	"
Interest, &c.,	8	"
Bringing the whole allowance up to about	20	"

"The Engineer" gives the cost, in England, for 100 horse-power engine with boilers and "plant" complete, as being \$75.00 per horse-power, and the cost of fuel, &c., at \$50.00 per annum.

I find that the mills, from which Mr. Webber's cost of power is taken, consumed about six tons of coal per horse-power per annum, which cost nearly \$7.00 per ton. Engineer's and firemen's wages, oil, &c., including delivery of coal, \$8.00 per horse-power per annum.

In making this application to Canada, I will take the low price of \$5.00 for steam coal, without reference to its quality or heating properties.

Cost of a horse-power per annum in cotton manufacture :—

Six tons per horse-power per annum at \$5.00	\$30 00
Engineer, fireman, oil, &c.....	8 00
Engine, boiler, plant complete, \$100.00 at 20 per cent.	20 00
Total cost.....	<u>\$58 00</u>

Cost of a horse-power per annum in the manufacture of cotton by water-power upon the Beauharnois Canal :—

Wheels, pits and flumes cost say \$25.00 per horse-power at 20 per cent. interest and depreciation	\$3 00
Heating and dressing per horse-power.....	3 00
Montreal Cotton Company's lease H.P. per year.....	1 00
Total cost.....	<u>\$7 00</u>

I have no means of determining the actual cost of any of these mills' wheels, pits, and flumes; the head at Beauharnois is stated as 15 feet, the best turbines in the United States would cost about \$6.00 per horse-power under that head, leaving \$19.00 per horse-power for pits, flumes, &c., which may be more or less, if it is doubled it would not affect the comparison.

The Stormont Cotton Mills, Cornwall, are paying about \$1.00 per year per horse-power for the water they are entitled to, and 45 cents for what they use.

George Stephen has sub-leased at Cornwall, to the Canada Cotton Co., power, I am unaware what they pay him. The Government receives 67½ cents per horse-power per annum for what is leased, and 27 cents on the amount used.

The stock in these Companies has risen enormously. They are said to be paying large dividends: doubly protected, by the tariff, and by the nominal figure they pay for their power.

The water-power formed by the fall at a lock is constant, the levels of the canal unvarying. At Cornwall and elsewhere where the tail races of the mills discharge into the river, they are liable to backwater and loss of power. It is contended, on this account, and with the liability of total stoppage, the power is of little value; as engines have to be provided they might as well use steam altogether. That this is not the case can be shown; every horse-power of water used is a direct saving of so much fuel. In the following comparison I shall not take the low figure now charged for power, which would make the differences much larger, but the assumed value, as previously stated, \$10.50 per horse-power per annum.

The following figures are not founded on the cost per horse-power per annum, in the manufacture of cotton in Canada, but assumed for illustration. In the Hudon Cotton Company, Montreal, the cost at that mill is said to be determined; but for some reason the manager refused this information. Those Companies leasing water-power from the Government would not probably furnish information for an enquiry of this kind.

Take for example, a cotton mill manufacturing average number of yarn 14, with 12,000 spindles, requiring 300 horse-power.

1st. Cost by water-power per annum for running mill:—

Water, 300 horse-power, at \$10.50.....	\$3,150 00
Wheels, pits, flumes, &c., \$7,500, at 12 per cent.....	900 00
Incidental, heating and dressing.....	1,000 00
Total	<u>\$5,050 00</u>

2nd. Cost when mill obtains 300 horse-power from water, two-thirds of the year; loses one-half power one-third of year from backwater. Using steam as an auxiliary, provides engine power sufficient to drive all the machinery in event of stoppage:—

Water, 300 horse-power, at \$10.50.....	\$3,150 00
Coal, 300 tons, at \$5.00.....	1,500 00
Heating and dressing.....	750 00
Engineer, fireman, oil, &c	1,425 00
Engines, boilers and plant \$30,000, at 12 per cent....	3,600 00
Wheels, pits, flumes, &c., \$7,500, at 12 per cent	900 00
Total cost as above.....	<u>\$11,325 00</u>

3rd. Cost when mill obtains 200 horse-power from water, two-thirds of a year, requiring 100 horse-power of steam auxiliary; from backwater requires 200 horse-power of steam one-third of year. Provides engine power to drive all the machinery in event of stoppage:—

Water, 200 horse-power, at \$10.50	\$2,100 00
Coal, 800 tons, at \$5.00.....	4,000 00
Heating and dressing.....	500 00
Engineer, fireman, oil, &c	1,550 00
Engines, boilers and plant, \$30,000, at 15 per cent....	4,500 00
Wheels, pits, flumes, &c., \$5,000, at 12 per cent.....	600 00
Total cost as above.....	<u>\$13,250 00</u>

4th. Cost of steam power for running mill, per annum—number of spindles, 12,000; horse-power required, 300:—

Tons of coal per annum, 1,800, at \$5.00.....	\$9,000 00
Engineer, fireman, oil, &c	2,400 00
Engines, boilers and plant, \$30,000, at 20 per cent....	6,000 00
Total cost as above	<u>\$17,400 00</u>

This comparison shows, at the low figure, \$5.00 per ton for coal, there is an annual saving of \$12,000 between water and steam; \$6,000 where backwater has to be provided for and engine power for all the machinery; \$4,000 using steam all the year as auxiliary power and providing for backwater, &c. If we substitute the actual amounts the mills pay the Government for power, not one-third of the amount taken in this comparison, these figures will be much larger.

A mill privilege, including water-power for this number of spindles, would cost, half a century ago in Lowell, \$48,000, or at 6 per cent., an annual rental of \$2,880.

The Montreal Cotton Company, on the Beauharnois Canal, by the terms of their lease, for millsite and water-power, for this number of spindles, would pay \$300 per annum.

The Stormont Cotton Company, for a mill site and water power with nearly this number of spindles, are paying \$270 per annum, and are enlarging their mill for double this number of spindles.

The value of water power depends upon its situation. In Canada, with immense rivers, and rapids, constantly in view, the community, naturally do not recognize its full importance, and even those using it do not appreciate the value, forgetting the cost required to obtain this power in any favorably situated locality. The general apathy

Water power dependent on its situation for value.

in these matters has caused loss of revenue, waste of water, established an indifferent set of mill owners, who, paying nothing for their power, use and waste water with rude appliances, it being immaterial what kind of machinery they may use, so long, as they obtain water for nothing, thereby preventing the growth of other industries, and in the past have been, and now are, an absolute injury to navigation.

I have shown, in a report upon the Lachine Canal, that these water-powers were not a necessary attendant on the construction of a navigable canal, that there was an additional expenditure to create them; the general public taxed, ostensibly for navigation, in reality, for the benefit of private individuals, who return in revenue one-fourth, and the other three-fourths into their own pockets.

Thirty years ago, the Government established the value of water-power at £12 10s. per run of stones, or \$5.00 per horse-power per annum. As the country advanced, and this power became more valuable, the amounts charged have become gradually less, until now there is obtained, under one dollar for a horse-power per annum.

Without referring to the canals, in the back country, where power is necessarily less valuable, take the Welland and St. Lawrence Canals, on the water highway, for some months in the year, of a large portion of the continent, and all are, or will shortly be, connected with railway communication. None of the Water-Power Companies, in the Eastern States, are in a situation similar to Basin No. 2, Montreal, where the ocean and lake vessels can come to the door of the mills.

If the North-West meet the expectations of the country under the present protective policy, the water-powers upon these canals will be of great value, and should not be given as a bonus to manufacturers' who are considered to have all the protection they require.

When a private company in the United States, with only 10,000 horse-powers, employs an engineer with a world-wide reputation, expends large sums of money in experiments, which are published for the benefit of the scientific world, it might be considered the function of a Government in managing the immense water-power created by their Public Works, to adopt scientific methods, and afford means of educating the community in a department where there appears a lack of knowledge, in order that we might not be more than a half a century behind the former country.

On the enlarged canals the Department should manage these powers in the same manner as a private company. The community being taxed for local and private benefit, the full value of the power should be demanded, and a revenue derived which would be some return for the large expenditure upon the canals. It would be no difference in principle, and quite as logical, for the Department to furnish boilers, engines, fuel, and lease the steam for \$8.00 per annum per horse-power to a cotton mill, as to construct works necessary to furnish water to the mill and lease the power at one dollar per annum. The portion, of the expenditure upon the construction of a canal for navigation, that is chargeable to water-powers, is the amount, it would cost to furnish the same power by works for that purpose solely, in the locality of the canal. This cost, or the capital, upon which the lessees of water-power should pay interest, being difficult to ascertain, a just precedent is what private companies consider a return for their capital, which has been stated previously.

If, it is decided to cultivate this source of revenue, provision should be made to enable the greatest amount of water, that could be drawn from the canals without injury to navigation, to be utilized for power.

Water-power, under control of Canadian Government, not to be considered as a bonus to manufacturers, and should be managed in the scientific manner adopted elsewhere.

There should be no monopolies of the whole power at any lock, or number of locks, for the purpose of sub-leasing or otherwise; such was the opinion of the Commissioners of Public Works thirty years ago, in reply to an application for such a privilege. They state:—"While they cannot see there would be a greater stimulus given for the employment of the water-powers, by transferring the entire control of it to the company, as proposed, the Commissioners are of opinion that it would be highly inexpedient that the Government should cease to have the full and unrestricted control of the water now available on the line of this important work." (Welland Canal.)

There should be established a fixed value for mill sites and water-power, and leased upon application; if more than one application for a privilege it should be offered by auction, with this fixed value for an upset price. If the whole power created by the enlargement were thrown upon the market, or leased indiscriminately at what was offered, small prices might be obtained, an inferior class of manufactories established. As the country developed industrially, there would be no power available for the important manufactories that might arise.

A fixed value for mill sites and water-power should be established.

As an illustration of the importance of this recommendation, and the effects of the alienation from the control of the Government of their land and water-power, I may refer to the immense power that might have been obtained at the Chaudière Falls, Ottawa; if developed in the manner the water-powers in the Eastern States are, it would be one of the largest powers in the world. This power is not under the control of your Department, but, leased, under the same system, before the Department of Public Work was divided, it serves as an illustration.

Effects of the alienation of mill sites and water-power by the Government.

The Government having expended a sum of money for hydraulic dams, and other improvements on the south side, the land adjacent to the falls was sold and the water-power leased. Now, when there is a demand for power in the city, it cannot be obtained. There is a large amount of power constantly going to waste, the situation for mills has been sold and occupied principally by saw-mills, and as piling ground for lumber. These mills only work one-half the year, the other half the power goes to waste. They employ little labor, in comparison with cotton or woollen mills. They are the only description of mill which manufactures its own fuel. Steam is to them as cheap a power as water; their monopoly of the power is a direct loss to the productive capacity of the community. If the Government had retained control of this land and water, and the power developed upon scientific principles, Ottawa, occupying a central position and on the line of the Pacific Railway, when the West has a great consuming population, a class of manufactures might be established which would support a large industrial population.

The Government leased some 250 runs of stones, or 2,500 horse-powers. There must have been little value returned for expenditure, as the Inland Revenue Report shows some \$40,000 of rents in arrears. The head, or fall, is said to be from 20 to 30 feet. As the head decreases the supply of water increases, thus compensating for loss of power by the greater quantity of water available.

T. C. Clarke, Esq., in his report upon the "Ottawa Ship Canal," at a dam which he proposed to build above the Little Chaudière, gives a discharge over the crest of 25,000 cubic feet per second at extreme low water, and 130,000 cubic feet per second at high water, which would give an unfailing power of some 62,000 effective horse-powers, and a much greater average power.

The rates charged for power was \$2.00 per annum per horse-power, which would give a revenue of \$124,000 per annum, or if all leased at its present value, say \$8.00, \$496,000 per annum.

The Government developed the power upon the south side. If a scheme had been carried out of obtaining a power, at low water, equal to 10,000 cubic feet per second upon the south side, the same upon the north, and allowed 5,000 cubic feet per second to waste over the falls, we would have 9,000 cubic feet per second at the lowest water available for power and revenue, as these lessees are entitled to 1,000

cubic feet per second. For any quantity of water used above this, or wasted, the country obtains no revenue, and the establishment of manufacturing industries prevented.

The financial element enters largely into the question of water-powers upon the canals. I have stated elsewhere, that, if a private company were building them, the power formed by the fall at the locks would have been considered in the original design, and the structures arranged for the eventual utilization of the greatest quantity of water which could flow through the canal without injury to navigation. Although this has not been the case upon the Canadian canals, the scheme that is proposed will have that object in view whenever applicable.

A thorough system of managing these powers could then be adopted, with the principal aim of ultimately, as the country progresses, deriving a revenue from them sufficient to prevent the community from being taxed for the maintenance, as well as the construction of the canals.

The revenue from the St. Lawrence and Welland Canals has not this last year balanced the expenditure for repairs and maintenance. The question of free tolls upon the Erie Canal is before the people of the State. Before long our canals will probably have this additional competition from the rival route. We have, therefore, to consider what the country has gained by the large expenditure in the construction of canals, and what will be the results of the enlargement. How far the competition, of rival water routes and railroads, will affect the enlarged system. The old canals were never worked to their full capacity, and were large enough for fifty years for the needs of Canada. The enlargement, may then be considered, to have been undertaken for the purpose of diverting, from other routes, the transport of the products, and imports, of the Western States; that is, for the profits to the country, direct or indirect, derived from the passage of a bushel of American grain, or other product, to the European market, through the Canadian canals, and from what imports may return by the same route. We have never, in the past, succeeded in diverting from the Erie Canal its trade, and in this respect are falling behind each year. The decrease in the transport of vegetable food between 1869 and 1880 was 7.76 per cent. upon the Welland Canal, and the increase upon the New York Canals, 82 per cent.; in heavy goods the decrease upon the Welland Canal was 40 per cent., and upon the New York Canals, 14 per cent.

The following figures, are round numbers, taken for comparison. The Canadian Canals, with a debt of say \$20,500,000, contributed to the revenue, in tolls from 1850 to 1880, say \$10,000,000; in the same period the New York Canals, with a debt of \$16,500,000 in 1850, and in 1880 of \$9,000,000, contributed to the State, tolls amounting to \$89,500,000. They have decreased their debt nearly one-half, and we have received one-ninth of the amount in tolls for our \$20,500,000. The tolls to the State of New York from their canals, from 1837 to 1880, were \$119,699,547, deducting repairs and cost of collection, \$45,098,240, there was a surplus of \$74,661,307.

The Erie Canal has been termed a "ditch," while we have had a magnificent water-way with less mileage of canal, and locks treble the capacity, but we have done no business, and proved that the conclusions and predictions of the promoters of the first enlargement were erroneous.

The St. Lawrence route is the natural outlet for a large portion of the United States; previous to the construction of the Erie Canal the trade of the lakes came to Montreal; at the opening of that canal it was diverted to New York, and although we expended large sums of money to regain it, we have never succeeded.

In 1811, the Erie Canal Commissioners stated:—"Articles for exportation, when once afloat on Lake Ontario, will go to Montreal, unless our British neighbors are blind to their own interests." With reference to this opinion the Commissioner of Public Works, in 1851, states:—"The St. Lawrence has not changed its character nor lost the superiority it thus possessed, but forty years have passed away since the remarks of the Canal Commissioners, and we still remain blind to our own interests."

Water-powers created upon the Canadian canals become of importance if the enlarged system of navigation fails to attract the exports of the Western States.

After expatiating on the magnitude, and grandeur, of the navigation, which by a short artificial connection would command the trade between the interior and the ocean, either by Quebec or New York, he directs the attention of His Excellency to the result realized from the canals of New York and Canada, the one yielding an amount of treasure wholly unlooked for, the other disappointing the reasonable expectations of all its early projectors, he then states that an effectual remedy to this condition of things is the construction of the Champlain Canal.

With our \$15,500,000 more than necessary expended upon this route, and a capacity to transport treble the greatest quantity that the Erie Canal has ever done, we are still in the same position, if not worse, as when the Commissioner of Public Works made his report thirty years ago. We were not "blind to our own interests," the country expended large sums of money, but the articles of exportation, however, never floated upon Lake Ontario, or went to Montreal.

We are now starting upon a new era of competition against the Erie Canal, with a debt of \$9,000,000 and perhaps free tolls; while the Canadian route has, when the Welland is deepened to 14 feet navigation and the St. Lawrence to 12 feet, some \$44,000,000 of debt. In June, 1850, T. C. Keefer, Esq., C.E., reported upon the probable annual revenue of the Provincial Canals, and assumed that one half of the Western trade could be attracted through the Canadian canals, and the increase thereafter estimated at 20 per cent. per annum, the same rate of progress sustained by the Erie Canal for fifteen years.

The estimated annual revenue from 1850 to 1866 was, from the Welland and St. Lawrence Canals, \$18,500,000; or, taking the same yearly revenue as taken for 1866 and carrying down to 1880, we would have as the estimated revenue from 1850 to 1880, \$43,500,000, against the \$10,000,000 that have been collected from all the canals.

The yearly estimated revenue from the Welland and St. Lawrence Canals, Richelieu River, &c., was to be, in 1866, \$2,000,000; repairs and management, \$100,000; annual sinking fund, \$1,600,000; annual surplus of revenue, \$300,000. It is slightly different from the financial exhibit of the canals in 1881. The Commissioners of Public Works, in the report of 1851, recommended the construction of the Champlain Canal, and one of their arguments was:—"The Welland Canal has increased in a greater ratio than the Erie, and the Oswego route has progressed more rapidly than the Buffalo one, simply because it shortens the boat canal 154 miles, and increases the length of the voyage to the lake craft." Time has proved the fallaciousness of these assertions and estimates, and the money expended on the canal useless for the purpose intended. For the requirements of the trade of Canada, and for as large a business as has ever been done upon the Erie Canal, it is evident that all that was required was the Welland Canal with its 10 feet navigation, and a barge navigation on the St. Lawrence equal to the Erie Canal. We may therefore assume, as far as the transport of the exportations of the Western States is concerned, that all the expenditure upon this route, more than was necessary to secure a navigation of this description, was thrown away, for it would have met all the requirements of Canada for years to come, that is, until our exportations would equal the large trade done by the Erie Canal, represented by \$119,699,547 in tolls for forty-four years. That is, for some \$10,000,000 we would have had a better route than the Erie route, suited to all the requirements of Canada for the last thirty years, and until our export trade increased to the extent mentioned above. If the cost of the present enlargement is included, we would have \$34,000,000 expended, to carry out the original idea of diverting from New York to its natural channel, the St. Lawrence, the exports and imports of the Western States.

To discuss the many causes, which prevented the canals from realizing the expectations of their original promoters, is not necessary. The principal cause is political rather than economic. The great water highway, of the Lakes and the River St. Lawrence, being in possession of two foreign nations, with adverse political and commercial systems, its outlet being through the territory of a country, alien to the people, the transport of whose productions and imports is essential to make our

canal system a success, has rendered us unable to attract the exports and imports of the rich country geographically, and economically, tributary to this route, and will in the future militate against the enlarged canals.

It is asserted one of the causes which enabled the Erie Canal to retain its transportation of the exports of the Western States, was the large class of vessels plying between Chicago and Buffalo, which could not pass through the Welland Canal. This cause will still operate upon the enlarged canal, vessels, now when the water at the "Lime Kiln" crossing Detroit River, is high, load down to 16 feet or 4 feet below Welland Canal depth, the Americans are still excavating at this channel, and it is stated, it is the intention and desire of those interested, to obtain a depth of 20 feet.

The State Engineer of Canals, New York, states in his last report that every foot in depth below Welland Canal capacity, the harbors and channels are deepened, is an additional protection to the Erie Canal, that the Federal Government should be called upon to expend money for this object, while the State should deepen or raise the water in the Erie Canal, to give another foot in depth, to meet the competition of the Welland Canal. We thus see if the large vessels above the Welland Canal were such an important element before the canal was enlarged, they will still continue to be, both for the Lake Huron and Lake Superior trade, as the Sault Ste. Marie Canal admits vessels of a larger draught of water than the Welland.

The competition of railways to both the Erie and Welland Canals has to be considered. By the rupture of the agreement between the trunk lines of railways last season, it had the effect of reducing the receipts of wheat at Buffalo by Lake; from the opening of navigation up to 1st July, 1880, there were received 40,587,000 bushels, at a freight of 6c. per bushel, and for the same period of 1881, 20,361,000 bushels at 4½c., or one-half the quantity, at some 25 per cent. less freight. The freight from Chicago to New York, *via* Lakes and Erie Canal, in August, was 7½c.; by the railways it was 10c. to 12c. per bushel, the water route did not compete with 3 to 4 cents in its favor.

It is evident, if the St. Lawrence route is to obtain to any extent the transport of American cereals, that the cheapening of transport by it must compensate, for the preference ocean vessels and steamers have for New York, for the less rate of insurance, &c., at that port, for the advantages of the larger class of vessels used between Chicago and Buffalo, which cannot pass the Welland Canal; besides, there is the difficulty of breaking up a long established channel of commerce, with enormous capital and interests at work for its protection, and establishing it through a country owned by a foreign power.

On comparing the two routes, we have Chicago and New York *via* Erie Canal, 1,419 miles. Chicago to Quebec *via* Welland Canal and St. Lawrence, 1,421 miles. Quebec is taken instead of Montreal for this reason; the tendency of ocean vessels is to increased size. The large ocean steamers expensively equipped, will not, if sufficient accommodation is provided at Quebec, undertake 160 miles of river navigation, with all the difficulties of handling vessels of that length, and dangers attendant upon river navigation, liable to be frozen in in autumn, rendering a large capital inactive for nearly half the year, when a few barges and a tug could transport her cargo. The same principles applies to the lake steamer, or propeller, whether it would run from Chicago to Quebec and tranship into the ocean vessels, or to Kingston and tranship into barges. It would appear cheaper for the lake vessel to tranship at Kingston, and return for another cargo, the expensive vessels making more trips in the season and the barge more economical in the river and canals.

We then have Chicago to Buffalo, lake vessel, 916 miles. Buffalo to New York, barge, 503 miles. Chicago to Kingston, lake vessel, 1,083 miles. Kingston to Quebec, barge, 338 miles. The Canadian route has all the advantages in its favor, with the exception of the larger class of vessel that can be used on the lake portion of the Erie route.

In August last the average freight between Chicago and Buffalo, was 3½c., at the opening of navigation this year it was lower than that. The canal freight, in August, was 4½c. Apart from railway competition, the Canadian route may have to compete

with a 3c. freight from Chicago to Buffalo, and a 4c. freight from Buffalo to New York, or 7c. from Chicago to New York. The free tolls upon the Erie Canal will make a great difference, for, in 1880, the tolls were \$1,555,419, and the freight to carriers \$4,833,526, or say 25 per cent. of the cost of transport. It would seem, we would require less than 7c. freight between Chicago and Quebec to divert the trade from the Erie Canal;—if not diverted, and the canals keep falling off in their receipts as they have been doing for some years, we will have the immense sum of money expended on the enlargement futile and additional taxation for repairs and maintenance;—if diverted, it can only be done by free tolls, we would in that case have the additional taxation for repairs and maintenance.

These remarks have been made to show, that the present enlargement may be as disappointing as the previous canal system, in attaining the objects for which it could only have been undertaken.

There is now the competition of several rival trunk lines of railroads, and the cheapening of transport by the use of the steel rail and other improvements, factors not taken into consideration by the original promoters of the canals, who would have been incredulous if told that wheat would be carried by rail from Chicago to New York for 10 cents, and *via* Buffalo and Erie Canal for 7-2 cents per bushel.

It may be asked what application this question of transport has to the water-powers; it is this: to attract the trade, hitherto ineffectually sought after, may require free tolls upon the St. Lawrence route, and in addition to the interest upon the \$44,000,000 the community will be taxed for the maintenance and repairs of the canal. Be the advantage greater or little from the transport of a bushel of grain from Chicago to Europe *via* the Canadian canals and Quebec, it is, to a certain extent, a national question affecting many interests. On the other hand, the water-powers are local and have been in the past for private benefit; they should therefore be dealt with in a business manner, the largest revenue possible obtained from them, and such a system adopted that would prevent in the future what has occurred in the past, and the immense power available upon the canals conserved and utilized upon scientific principles for the benefit of the rapidly increasing manufacturing industries of the country, and for some return for the large capital invested in the canals.

In a report upon the Lachine Canal it has been shown in what manner a large increase in revenue from hydraulic rents can be obtained, also a sketch of the method to be adopted upon the enlarged canal. Upon examination of the water-powers upon the Welland Canal I hope to show a larger source of revenue.

The present forms of lease do not appear, either legally, or technically, to be of sufficient precision and clearness. New forms should be drawn up for the water-powers upon the canals. Through the kindness of the gentlemen managing Water-Power Companies in the Eastern States, I have received, for the use of the Department, several of their blank forms of lease which would be valuable as precedents in drawing up a new form, in case any objections were made by lessees to any of the stipulations.

If it is your intention to adopt a new system, and obtain the present value of power, it might be advantageous, to afford hydraulic lessees the opportunity, to introduce a better class of machinery or water motors than at present in use. Little attention has been paid to this subject in Canada. Many men, who have a foundry and machine shop, consider they can turn out a satisfactory turbine, either by copying some description of wheel manufactured in the United States, or adopting the plans of some individual, with a certain practical knowledge of water wheels, who imagines he has designed a wheel of high efficiency, when it may violate the most elementary principles of hydrodynamics. Wheels manufactured in Canada have been placed in the mills of hydraulic lessees upon the canals at great expense, and have been replaced by others of American manufacture. As it has been proposed elsewhere to charge for power at 75 per cent. of the theoretical power of the water, lessees should not be required to make these expensive experiments. If a new system be adopted, and a sufficient revenue obtained, it would be only due the hydraulic lessees, that the

Present forms of lease should be changed.

Hydraulic lessees to be afforded the means of determining the best class of water wheels or motors.

means be given them, to test the efficiency of the wheels they may purchase, the condition of which would be, that they should give a stipulated efficiency at the Government testing flume, which could be erected at some central and convenient point upon the canals. This flume would protect the Canadian makers manufacturing efficient turbines, who at present have to send them to the United States to determine their value in comparison with those of other makers of turbines, and to obtain a certificate of their efficiency. It would also lead to the introduction of a better class of machinery upon the Canadian canals.

The following remarks, made by Mr. Francis, with reference to the United States 27 years ago, are partly applicable to our canals at the present time:—"The northern regions of the United States of North America probably possess a greater amount of water-power than any other part of the world of equal extent, and the active and inventive genius of the American people, combined with the very high price of labor, has had a powerful influence in bringing this power into use. Nevertheless, the water-power is so vast compared with the population that only a small portion of it has up to this time been applied to the purposes of man.

The great abundance of water-power in this country has had a strong tendency to encourage its extravagant use; the machines used in the manufactories are usually great consumers of power, the ability of a machine to turn off the greatest quantity of work with the least manual labor and in the least time has been the point mainly considered; and whether it required a greater or less amount of power has been a secondary consideration.

The engineering operations connected with the water-power at Lowell have frequently demanded more definite information on certain points in hydraulics than was to be found in any of the publications relating to that science, and hence has arisen the necessity from time to time of making special experiments to supply the required information. Whenever such emergencies have arisen, the officers who have the general care of the interests of the several corporations, with a liberality founded on enlarged views of the true interests of the bodies they represent, have always been willing to defray such expenses as were necessary in order that the experiments might be made in a satisfactory manner."

It is hoped, this and other reports will enable you to form some idea of the position practical hydraulics, to which so much attention has been given in the United States, occupies upon the Canadian canals.

I have the honor to be, Sir,

Your obedient servant,

ROBERT C. DOUGLAS,
Assistant Engineer, Railways and Canals.

OTTAWA, May 1st, 1882.

SIR CHARLES TUPPER, C.B., K.C.M.G.,
Minister of Railways and Canals.

SIR:—

In accordance with your directions, I beg leave to submit the following report upon the water-powers, situated along the line of the Lachine Canal.

I commence with a number of extracts from Departmental Reports, and Documents; these quotations might be considered of unnecessary length, were it not for the following reasons:

You, probably, are unacquainted with these records previous to Confederation; the condition of things existing upon the Lachine Canal, before the present enlargement, may be unknown to you.

The principles, effecting the leasing of water-powers upon the navigable canals, the method, and manner, in which these leases were made, the results, and consequences of the system, or no system, which has prevailed, are unmistakably exemplified.

Upon this canal, all the evils that pertained to that system, have been intensified, and are narrated year after year in Reports; the authorities being apparently powerless to adopt any remedial measures.

The Lachine Canal Enlargement is completed, in so far as the quantity of water flowing through it, available for hydraulic power, is concerned.

It is hoped, this Report will demonstrate the necessity of a change, and will enable you to form an opinion of the policy, you may consider requisite, to adopt upon the enlarged canal.

Extracts from Departmental Reports.

The first reference to hydraulic powers, is in the Report of the Commissioners of Public Works for 1844:—"We have acquired a certain amount of land, adjacent to basins at Montreal, for enlargement of canal, when the works are completed some of this land can be disposed of by lease, or otherwise, for objects connected with the use of the canal; and the amount to be derived from this source, as well as from the water-power that can be created, and may be disposed of without detriment to navigation, may be estimated without fears at £100,000."

The Commissioners' Report of 1849:—"The waste weirs have now become necessary, not only to regulate the water in the Canals (Cornwall, Beauharnois, and Lachine) but to neutralize the disturbing effects of the mills which have been built along the line."

Commissioners' Report 1850:—"All the disposable water, at the Montreal terminus, and at St. Gabriel, is now leased, and by the time the necessary erections, and machinery, are prepared, much more enlarged means must be afforded, to ensure a steady, and ample supply to them, without affecting the navigation."

An estimate for the following year "connected with hydraulic privileges," £13,230.

Appendix D, No. 5, W. H. Merritt, Commissioner, states:—"For procuring the money, debentures could be issued, at 5 per cent. interest, and for all objects connected with the St. Lawrence, the security should be,—

1st. Surplus tolls, after setting apart the amount, specified for the sinking fund.

2nd. The hydraulic rents.

In Commissioners' Report of 1851:—"Connected with the hydraulic privileges, a large waste weir of 100 feet length of overfall, for regulating water in the basin, has been built. The old locks have been converted into waste weirs, and by this means, a full supply of water kept up. The flume, around the Guard Lock, at

Lachine, intended to supply more water to the canal, is about to be placed under contract.

"The new works, which have thus been accomplished, on the line of the St. Lawrence canals, have been productive of the greatest advantage to navigation; and, moreover, have very materially assisted in the development of the water-powers, as the statement of water rents will clearly show."

On the 25th March, 1852, Hon. John Young, then Commissioner of Public Works, also one of the lessees of hydraulic powers, issues instructions for the guidance of the Engineer of the Board, on his tour of inspection, contained in which is,—“While on the spot, Mr. Keefe will decide on the most expedient mode, of affording a greatly increased inflow of water to the canal, which is indispensable, to meet the wants of the trade, and the millers.”

Report of Commissioners for 1852, and 1853, speaking of Tate's hydraulic privilege for dry dock, to which four runs of stone were allotted, and sold under the report of the Engineer of the Department:—“It is to be regretted, that this property had been so disposed of, it is directly in the way of the improvements which the trade requires, and the works erected upon it, in their present state, must be considered as a nuisance to the canal, the unsuitable construction of the works, causes a great unnecessary waste of water. But little progress has been made with the works of the supply gate, and channel, at the head of this canal, for the admission of a greater volume of water.”

The first complaint, about the Hydraulic powers, I find in the Department, is from A. Cooke, Esq., M. P., December 9th, 1854:—“My attention has been drawn, to the fact, that the granting of water-power, or mill privileges, on the Lachine Canal, is a great evil, and if persisted in, will become yet greater. The past season it was found necessary to restrict the number of lockages through the canal, for the purpose of retaining the water that would thereby be used, in order to reserve it for the use of mills, now in operation near its outlet, and it was accordingly decided to make the restrictions upon lumber, therefore, the lumber trade had to submit to the very great inconvenience of passing only three lockages per day, through the canal during the past season. To remedy this evil, I am informed it is the intention of the Government, to construct a feeder at the head of the canal, to furnish the water that may be required. Should the Government construct a feeder of this kind, it is believed, that it will cause a current through the canal (when the mills are working) of not less than three miles an hour. * * * * * Having said enough to enable you to see the very great error, that will be committed if the Government persist in granting mill sites, to be fed by the canal, or by opening a sluice at the head of said canal for the purpose of increasing the water-power.”

This letter was acknowledged, saying, the subject was now under the serious consideration of the Department.

Mr. Cooke's estimate of excessive current will be substantiated by evidence subsequently.

With reference to this year, Mr. Sippell, Engineer of the Canal, writing to the Department in 1859, states:—“In 1854, it was found impossible to furnish a sufficient supply of water, for the mills at this lock (St. Gabriel,) and at the same time maintain navigation. When called upon to use less water, they paid no attention, and the Superintendent was compelled to send a diver to spike the gates below water, to prevent them from stopping navigation.”

Mr. Sippell, to Secretary of Public Works, 22nd February, 1854:—“I beg to state, that yesterday afternoon there was great complaint made by the millers, for the want of water, the water in the canal being too low to drive their machinery.

“Examinations, were immediately made, to ascertain the cause, and it was found that the facilities for supplying the canal at Lachine were not sufficient. The gates in the old lock, and all the valves in the enlarged lock were open, (thus showing the necessity of having the supply weir, and raceway around the Guard Lock completed at an early day.)”

Commissioners' Report, 1855:—"The facilities for insuring a greater, more uniform, and more constant supply of water, at the head of this canal, are much increased by the construction of new head gates, and raceway, on the south side of the Guard Lock.

Notwithstanding, this important improvement, the demand for water for the extensive machinery, already established, and which may yet be established, upon the line of this canal, as well as the necessity of affording greater facilities to the trade, render the widening of the portion of it, through the rock cutting, near the Lachine Terminus, absolutely indispensable."

Commissioners in same Report, speaking of the Cornwall Canal:—"Several applications have been made for the leasing of hydraulic powers on the line of this canal; but the very serious inconvenience to the trade, repeatedly, and annually complained of, as to the manner in which the water is taken from the canals generally, renders the further establishment of water-power, on this as well as the other canals inexpedient, until an appropriation should be had, for the construction of certain works, connected with a better mode of letting out the water, so that it will not be in the power of the millers, to lower it below the navigation depth. The attention, of the Chief Engineer to the Department, has been directed to this subject, and his report thereon is hereunto appended." (The Report here alluded to, is not appended.)

Commissioners' Report, 1858:—"To enable certain improvements to be made, the principal of which, was the construction of a regulating weir through the raceway, on the south side of the canal above Lock No. 3, whereby the water passing to the manufacturing establishments can be controlled so as to prevent the necessary navigation level of the water being drawn down, &c."

Commissioners' Report, 1859:—"The river having continued high throughout the season, there has been no difficulty in keeping up the supply of water to the mills, but such is the increase of machinery, and the use of water, by the mills established on the line of canal, that it is very much to be feared when the river falls again to its ordinary level, there will not be a sufficient supply of water to keep them all going, without admitting a current in the canal, that would become a serious impediment to navigation. The enlargement of the rock cut ought to be proceeded with at an early date."

Commissioners' Report, 1860:—"Owing to the inordinate draught of water for milling purposes, at Montreal and Cote St. Paul, much difficulty has been experienced especially during the period of low water, in keeping up the different levels to the proper height."

Mr. Sippell, in his annual report says the above "difficulty, arises from the large amount of water, used for milling, and manufacturing purposes, on the south side of No. 2 at Montreal, which, as near as I can determine, has increased fully one-fourth during the current year." (There had been no more water leased). "The large increase of the amount of water now used for milling purposes, renders the necessity of constructing new weirs at locks Nos. 3 and 4 much greater than at any former period. The extension of the pier above Cote St. Paul cannot any longer be dispensed with; this extension is required to protect vessels from being drawn into the head of the old locks, by the strong current formed by the large amount of water passing through them, for keeping up the levels below."

The Department becoming aroused, a letter was addressed to Mr. Sippell, 28th September, 1860:—"It being desirable to ascertain correctly, the actual quantity of water used by the Lessees of water-power, on the south side of basin No. 2, Lachine Canal," he is requested to supply data for calculating the quantity. On the 20th October, 1860, Mr. Sippell sends a table of dimensions of orifices, apertures, &c., necessary for the purpose. He calls attention to leakage through the flumes, and dock wall, also to the large amount of water, used by Messrs. Tait in filling their dock, which amounts to 454,024 cubic feet, while it would require only 115,000 cubic feet if the dock were in proper order.

By referring to the extract, from the Annual Report of 1852-3, this dock, it will

be seen, was characterized as a nuisance, and allowed to continue in that condition for eight years, although the interests of navigation were suffering.

Commissioners' Report, 1861 :—"On the second basin above the outlet, which is from 20 to 22 feet on the usual summer level of the river, surplus water sufficient to drive sixty-five runs of mill-stones, has been leased, the greater part of which is in use. These leases, however, neither give the sectional area of the volume of water, nor the measure of power applicable to a run of stones." (It will be shown subsequently that there were regulations, specifying clearly the amount of water there, although not incorporated in the lease, they were read at the sale of the majority of the lots, and binding).

"This omission has led to the consumption of such a large quantity of water, as has already interfered, and threatens still further to seriously interfere with the efficiency of the canal, as the Lessees persist in using, and contend they have a right to use, sufficient water to propel the number of mill-stones stated, in their leases, irrespective of the volume of water, or power, required for that purpose.

"To supply the demand for water, produces a current, of from two to two and a half miles per hour in the narrowest part of the canal, and draws down the level above lock No. 4 from 10 to 12 inches, making the surface declivity, between that place and Lachine, about two inches to a mile."

Throughout the season of navigation, the reach between locks Nos. 3 and 4, can seldom be maintained at its proper height. During the past season of navigation, 471 vessels were detained an average of 2 hours and 10 minutes, and 59 were detained over 5 hours.

"These difficulties will be, to some extent, lessened, but not removed, on the completion of the works now in progress; the only effectual remedy being strict economy of the water, by the use of a better class of flumes, and limiting the openings through which the water is supplied to the wheels, and also the outlets from them, or establishing some definite measure of power. Unless some effective means be adopted, to remove this impediment to the navigation, the facilities which the trade demands for the speedy passage of vessels of full draught cannot possibly be afforded.

"The great current created in the canal, brings with it much silt, which, at many places, forms bars, and shoals, in the channel, which has annually to be removed.

"For the past two years, a steam dredge has been constantly at this class of work, yet such is the rapidity with which the deposit accumulates, that several places, dredged below the ordinary depth in 1861, must be again cleared out next season.

"Vessels have been frequently forced out of the channel, by the great indraught of water, at the upper entrance of lock No. 4, a pier in detached pieces, has been built obliquely to the line of canal, which has, in a measure, removed the difficulty."

It is, however, to be presumed that all the advantages to be derived from the enlargement of the "Rock Cut" to 100 feet, bottom width, and the construction of this regulating weir, will be, as far as practicable, confined to navigation, and will form no pretext for the present inordinate consumption of water for milling purposes, still less for increasing it.

Mr. Sippell, in letter to Department 5th April, 1861, states, that a surface declivity, of over two inches to the mile, is created during the season of navigation. "During last winter they had great difficulty, in getting water at the head, and the draught at the locks, so great, as to form a surface declivity of from 10 to 20 inches on each level."

Mr. Sippell in letter to Department 12th September, 1861 :—"The water is kept, at the depth of ten feet, on the lower mitre sill of Guard Lock at Lachine, from which the draught is so great at Cote St. Paul Lock, that the water is only nine feet in depth at upper entrance, causing a surface declivity of one foot between the two locks."

"All the mills above lot No. 9 are using water in the same proportion. I would therefore suggest, that the lessees of lots 9 to 19 inclusive, be requested to shut off say

one-eighth of the water they are now using, or so much as may be necessary to prevent them from drawing the levels below nine feet."

Mr. Sippell, in his annual report for 1861:—"Great detention has been experienced on the reaches below locks 3 and 4, in consequence of low water, caused principally by the mills on the south side of Basin No. 2."

"The basin, has been gradually filling up, for years, the current is even so great, the largest portion of the silt, and sediment, flowing in the canal, is brought down to this basin, where it settles, and some portions that were dredged in 1860, will require clearing again in 1862."

Commissioners' Report of 1862:—"The enlargement of the rock cut was completed last spring. The regulating weir, and raceway, at Lock No. 4, were constructed. These improvements have been undertaken, solely for the benefit of navigation, which has been, and still is, so much interfered with by the excessive quantity of water drawn off for mills, that it is absolutely necessary they should be confined to that object."

April 3rd, 1862:—A letter is addressed to the Chief Commissioner of Public Works signed by seven of the principal forwarding firms, from which the following quotation is taken:—"For some years past the navigation of this canal has been seriously affected, by the great flow of water drawn through the canal, for manufacturing purposes, so that the current at the bridges, and narrow points, has been such that vessels pass with considerable hazard, and difficulty, and often with delay, to the serious loss of those engaged in the business."

"The great quantity of water used by the mills also causes fluctuation in the depth of water, often drawing it below the depth required for navigation, leaving vessels aground for hours in the canal."

"It is therefore quite evident that the quantity of water used, for mill purposes, on the line of the canal, is much greater than should be allowed, and has converted, what was originally intended for navigation purposes, into a mill race, which is detrimental to the trade of the country. We would therefore pray, that steps be at once taken to limit the amount of water made use of for manufacturing purposes."

Mr. Sippell's Annual Report for 1863:—"The expenditure for repairs, and maintenance, is necessarily much larger, than for any other division of the St. Lawrence canals, caused by the strong current created in supplying water for the mills, the" &c., &c.

"A large portion of this expenditure is, however, caused by the inordinate current produced in supplying mill power, which tends to render vessels unmanageable, washes the banks, fills up, and forms bars, in the channel, and basin."

Commissioners' Report, 1863:—"The excessive current produced, in the canal, by the inordinate supply of water used, for milling purposes, at various points along the line, has led to so much difficulty in its navigation, as to be a heavy tax upon the trade."

"Representations to this effect, having been frequently made, by forwarders, and others, this Department, several years ago, took steps to limit the supply to what was then in use."

"But, notwithstanding, the uncertainty of furnishing even that quantity at low water, and the well known injury inflicted upon the trade, some of the lessees claim the right to a greater supply than they at present receive, although they have already fully double the amount of power considered available, at the time when the leases were granted."

"It would therefore appear, that the interests of these parties, are directly opposed to the successful, and unimpeded navigation, of one of the most important of the canals, and with a view of settling these matters, the whole question is now before the Provincial Arbitrators."

The arbitrators referred to above met in 1863. In evidence before them, Mr. Rankin, a pilot, states:—"I think since 1854 we have found a great current in the Lachine Canal. This current is very injurious to the navigation. It is more like a

mill race than a canal. The Lachine Canal is more dreaded with reference to injury of vessels than any other." Eight forwarders, and navigators, gave similar evidence.

Mr. Sippell in evidence, at the same time, states :—"The water for several years has been gradually raised below the Guard Lock from 9 ft. to 9 ft. 6 in. and 9 ft. 10 in. on the lower mitre sill. The object of this was to force water into the canal to supply the mills. There would have been enough without this for the navigation, had not the mills drawn off such a quantity. The millers continued to draw water as long as they could get it, without reference to the convenience of navigation."

Mr. Sippell in his annual report published in Commissioners' Report of 1864 :—"The navigation of the canal has been rendered difficult, by the draught of water required for propelling the machinery connected with them, so much so, that great complaints are made by forwarding interests."

Mr. Sippell in Report 1865 :—"The cost of maintaining these banks and walls is largely increased by the strong currents and by the passage of rafts; the currents wash the banks, form sand bars on the bottom, and undermine the walls, while the rafts drag and tear them down."

The Commissioners' Report of 1867 :—"The last Report on the Public Works of the United Provinces of Upper and Lower Canada, supposed to be a summary and retrospect, of every thing done previous to Confederation, thus speaks of the hydraulic powers upon the Lachine Canal :—"The propriety of leasing the surplus water of the canals is questionable. It has been urged in its favor, that manufacturers are, by this means, placed in immediate connection with the navigable waters, that it is a great advantage to mill owners to find ready for their purposes, an available water power, and that it gives, at once, a direct revenue to the Government, in the shape of rent, as well as an indirect revenue arising from the increased general prosperity."

Admitting these advantages, there are, on the other hand, certain drawbacks. One of the greatest of these is the increased current created in the canal, and the consequent inconvenience to vessels passing through. This inconvenience is so much felt at the present time, that the evil far outweighs all the advantages,—yet how much more must it be as the traffic through the canal increases.

The facilities afforded to commerce by Mills and Factories, so situated on Canal Basins, or Docks, as to be accessible to shipping, is undeniable; but it is equally clear, that it is most desirable, that the water power should be drawn from other, sources than the Canal itself, except in places where the quantity of water required, is too limited, to make it of any importance from what source it is derived."

Minister of Public Works Report of 1868 :—"Of late years, the water has been so low that much difficulty has been experienced in supplying this canal with sufficient water to maintain the requisite height on the mitre sills of the locks."

After considering various modes of remedying the evil, the Engineers of the Department have proposed to extend a pier from the head of the canal out into the current, with a view of embracing a larger volume of water, and conducting it into the canal (contract for which was signed 28th December, 1868).

Mr. Sippell in above :—"The present openings, for admitting water into the canal at Lachine, are not sufficient to keep the canal at navigable height, and supply water to the above mentioned mills, after it falls below twelve feet on the upper sill of the Guard Lock." Means for admitting a larger quantity, during seasons of low water, should therefore be provided.

On the 16th June, 1868, a letter is addressed to the Department signed by eight of the hydraulic lessees. They call the attention of the Minister "to the necessity which exists in view of the present low state of the water on the St. Lawrence, in obtaining a better supply for the mills." They wish another supply weir constructed at Lachine. "The Government cannot of course expect, that under the circumstances the lessees will be able to pay for that water which is not furnished to them. They offer to advance \$33,000 for its construction to be deducted from the hydraulic rents."

Exceedingly magnanimous offer, considering they had been using for the previous twenty years, four times as much water as they had any right to, and in direct viola-

tion of the conditions of some of the leases, which provided, that any water used over a specified amount should be paid for.

Minister of Public Works, 1869:—"The inconvenience, and obstruction, to navigation, resulting from the too liberal use of water for milling purposes, is particularly felt during these seasons of extraordinary low water."

Mr. Sippell in same report:—"On the 31st October, the gates in the Guard Lock at Lachine, were opened during the day, which increased the supply and gave general satisfaction to all parties. The gates were kept open until the close of navigation, but as great inconvenience was experienced, by the millers and manufacturers, from low water, it was considered advisable to re-open them, in order to afford, as large a supply of water, as possible during the winter. A considerable risk attended the proceeding."

Supply weir, mentioned above, for the benefit of the mills was placed under contract.

Minister of Public Works Report, 1872:—"From the month of September the St. Lawrence River was so low, that the gates of the Guard Lock had to be opened during the day, until the close of navigation, to admit the greatest possible flow of water to supply the canal and mills."

The new supply weir at Lachine was finally completed.

Mr. Sippell in same Report:—"During the months of July, and August, the force employed, by the contractor upon the supply weir, was not considered sufficient to complete the work before winter, which was the cause of serious complaints, by lessees of water power and other interested parties."

Minister's Report, 1875:—"The supply of water for driving the mills, owing to the low level of Lachine, was short during the entire winter."

We have now given, for a period extending from the time the water powers were first leased, until about the commencement of the present enlargement, the Departmental record of the administration of the canal, and these powers. Years of protestation and complaint without change or remedy.

Authority for Creating Water-Power upon Lachine Canal.

It may now be asked, by what authority, they have been engrafted upon the canal, and the extra expenditure necessary to create water-powers made?

In the Act of Parliament authorizing the construction of the original Lachine Canal, there is no reference to the creation of water powers upon it, nor in the Act 4 and 5 Vic., Chap. 28, which appropriates a sum of money for the improvement of the navigation of the River St. Lawrence, under which the Lachine Canal was first enlarged.

At the Union of Upper and Lower Canada, the Act, constituting a Board of Works, and defining its powers, has no allusion to them.

In November 1844, the Chairman of the Board of Works obtained the authority from the Executive Council to sell, or lease, water powers upon the line of the St. Lawrence Canals. There were, at that time, urgent applications for power upon the Lachine Canal. No action was taken upon this Order in Council, whether, because it was ultra vires, or otherwise, it does not appear.

A new Act, concerning the Board of Works, 9 Vic., Chap. 37, assented to in June 1846, has a clause, empowering the Commissioners of Public Works to lease water-powers, created by the construction of any public work, under the authority, and sanction, of the Governor in Council.

Mr. Barrett, the Engineer of the Lachine Canal, had made a Report upon the water-power available upon the Canal in 1844; this report was transmitted to Council in October 1846, and authority given for the sale of three mill privileges.

I cannot find, it was the intention of Parliament, to expend money, on the creation of water-powers, it being voted for constructing, or improving, a canal for navigable purposes. Neither had the Board of Works authority to create them.

Upon the Lachine Canal they were the result of an extra expenditure, above that

required to construct a canal for navigable purposes. Money would not have been voted for this local object, if it had been separated from navigation.

To illustrate this principle, at the present time, what occurred in the past, upon the Lachine Canal, take the Cornwall Canal; the openings at the head of the canal, and the weirs for passing water around the locks, are sufficient to supply all the water required for navigation, if the canal were enlarged, and worked to its full capacity. The mills upon it, are drawing from the canal, more water than is to the interest of navigation, and want more, they pay nothing for their power, practically speaking. If an amount were placed in the Estimates, to build a supply weir at the head of the canal, four times the capacity of the present one, and enlarge the waste weirs around the locks, it probably would not be voted, if known it was for the exclusive benefit of a few private individuals, to present them with cheap power, they already using more than they have right, or title to. But when stated it is required for navigation, that requirement being caused by the mills, it corresponds to what has occurred upon the Lachine Canal.

In the construction of a canal, the community would only consent to supply water-power to private individuals or localities, on the understanding that full value would be received for any extra expenditure necessary.

It is asserted manufacturers are encouraged, and that there are indirect advantages, these are local, and are similar to the ripples, from a stone cast into water, they become invisible at a short distance. The distant public contribute the same amount to the creation and maintenance, as the Lessees of hydraulic powers, or the locality to which they may be some benefit. On the Lachine Canal, the private interests of the Lessees were of greater importance than the public interests of navigation.

The Department had seemingly little control over this canal, as the same story is repeated, year after year, in reports, and nothing effectual done. There was an unnecessary expenditure upon construction, and an increased annual cost entailed for repairs and maintenance.

The mills were an incubus upon navigation for some twenty years. In one season 530 vessels were detained for periods of from one hour to six and three-quarters. If there had been any recourse, the demurrage might have exceeded the hydraulic rents for some time.

The Lessees contribute say \$12,000 a year to the revenue of the canal. Ten per cent. is little interest, on the proportion to be considered as the capital invested in water-power, including the increased expense for maintenance, renewals, &c. Previous to the present enlargement there was expended upon the Lachine Canal, \$2,600,000, for this expenditure, according to the evidence of those navigating the canal, the country had provided a mill-race for nineteen lessees. The \$120,000 and the mills were of greater consequence than \$2,480,000 and navigation. It has now to be decided whether, upon the enlarged canal, this capital shall have the proportion of \$120,000 to \$9,180,000, and whether the past shall be inflicted upon its future.

For a clear understanding of this subject, a history of these water-powers from their sale, or lease, appears necessary.

The legal questions involved, are beyond my province. In a necessarily imperfect examination certain facts have been obtained, which might be useful to the legal authorities in an investigation, when action will be taken upon the leases.

Facts for the legal
authorities.

Upon this canal, there are nineteen mill privileges, and one mill privilege, with a dry dock attached, at the Montreal terminus; at St. Gabriel lock, and at Côté St. Paul lock, the entire surplus water, and lands, not required for canal purposes, are leased at each place.

Any illegalities discovered in the original instruments may have no effect, as occupancy has been recognized by the Government, and rent accepted for a number of years; but if any surreptitious advantages have been taken, these facts may be of service when the renewal of the leases is claimed, upon the conditions inserted in them.

An Order in Council, No. 354, 16th October, 1846, by the powers conferred by the Act 9 Vic., chap. 37, authorized the sale of three mill sites, the terms of lease to be submitted to Council for approval, by the Commissioners of Public Works.

This order was based upon the report of Mr. Barrett, then Engineer of the canal. From the action taken at that time, it would appear, it was considered necessary, in order to comply with the Act, to obtain, first, the authority from Council to sell, and second, the sanction of the lease after sale. These lots Nos. 9, 10 and 11, were sold by auction upon the 23rd November, 1846. At this sale, regulations, conditions, and definitions, of Mr. Barrett, were read, and were binding upon the purchase. Lot No. 8, in addition to the above, was sold at the same time.

A certificate of the sale was sent to the Department by the auctioneer, stating that, upon the 23rd November:—"The above conditions (Mr. Barrett's) were read to the audience called together by public advertisement, and the leases were adjudged subject to the above conditions, as follows: to Lovett, Lot No. 9, to Peck, Lot No. 10, to McDougall, Lot No. 11, to Harvey, Lot No. 8." The leases for these lots were not executed at that time.

By an Order in Council, No. 378, 12th December, 1846, Lot No. 12 was authorized to be sold upon the 12th January next. On this day the same conditions were read and the lot awarded to Throne & Howard.

An Order in Council, No. 462, 29th April, 1847, granted authority for the sale of Lot No. 13. On the 22nd May, 1847, the same conditions as at previous sales, with some changes, were read, and the lot sold to Ira Gould. At the request of the company present, and with the consent of the Commissioners of Public Works, the adjoining Lot No. 14 was put up, and adjudged to Mr. Gould, upon the same conditions.

On the 3rd July, 1847, the Secretary of Public Works transmits a draft form of lease, with Mr. Barrett's conditions attached, for these three lots, and requests "the sanction of His Excellency in Council for perfecting the same in accordance with the Act 9 Vic., chap. 37."

On the 16th July, 1847, the Committee of the Executive Council advise His Excellency to approve of the same.

The lease for Lot No. 8 was not executed until the 7th September, 1849,—Lot No. 10, 10th March, 1848,—Lot No. 11, 16th October, 1848. None of these leases were submitted to Council, as specified by the Order in Council under which they were sold. They are weaker leases than approved of by Council. No reference was made to Mr. Barrett's conditions read at the sale, which defined the amount of water each run of stones was entitled to, and there were other important omissions which will be alluded to hereafter.

Lot No. 8 was leased to James Harvey, and transferred to Thomas Peck & Co., without consent of Department.

E. $\frac{1}{2}$ Lot No. 9 was leased to James Harvey and transferred to Thomas Peck & Co.; acknowledged March 5th, 1856, by Department.

Lot No. 10 was leased to Thomas Peck, now Peck, Benny & Co.

Lot No. 11 was leased to James McDougall, who now occupies it.

Lots Nos. 5, 6 and 7;—on the 16th October, 1849, Mr. E. E. Gilbert applies for three lots of land with water-power.

It is recorded in the minutes of the Board of Works, Hon. Malcolm Cameron, Commissioner, present, "in compliance with the letter of E. E. Gilbert, the Secretary to prepare a lease of mill privileges."

On the 20th December, 1849, Secretary of Board of Works, to E. E. Gilbert, saying: "I am directed to enclose form of lease for signature, of Lots Nos. 5, 6 and 7, Lachine Canal."

There is no Order in Council authorizing this lease.

On the 4th August, 1851, Mr. Gilbert assigned his rights, and interests, in Lot No. 7, and on 17th May, 1853, in Lots Nos. 5 and 6, to W. P. Bartly.

On the 3rd of September, 1854, he was discharged of all claims, and demands, a new lease was executed between the Commissioner of Public Works and W. P.

Bartly, for Lots Nos. 5, 6 and 7, and in addition the W. $\frac{1}{2}$ No. 2, and Lots Nos. 3 and 4. I can find no authority for this lease.

These lots were sold by Sheriff's sale on the 29th March, 1864, to a Trust and Loan Company, who subsequently sold them to the parties now occupying them.

Lots 15, 16, 17, 18 and 19; Tate's Dry Dock and mill privileges, the St. Gabriel water-power, were leased in February and March, 1851, by the Commissioner of Public Works. There is no direct authority for these leases. Certain transactions, with regard to some of these leases, and affecting the whole of them, will be dealt with more fully subsequently.

It would appear, that the Commissioners of Public Works had no more power, than any private individuals, to lease property belonging to the Government, if the terms of the Act were, at the time, not fully complied with.

This Act 9 Vic. chap. 37, specifies:—"The Commissioners of Public Works shall have such powers, authority, and capacities, as are provided by this Act, and no other powers, authority, or capacity, whatever."

The clause, in the Act, defining the powers, with regard to the sale of land, and leasing of water-powers, is summarized:—"Governor in Council may dispose of such property, as may not be required," and only under the authority, and sanction, of the Governor in Council.

The lease of only three of these Lots, conform to the Act. The Act also states:—"That the Chief Commissioner, for the time being, shall be the legal organ of the Commissioners, and all writings and documents, signed by him, and countersigned by the Secretary, *and no others*, shall be held to be acts of the said Commissioners."

The leases of February and March, 1851, as far as examined, are not signed by the Secretary, but are notarial instruments, executed by the Commissioner of Public Works, without authority of the Council, and lacking the countersign of the Secretary.

Lot No. 15 was leased to Biglow & Co., and was transferred to Pillow, Hersey & Co., without consent of Department.

Lot, No. 17, leased to W. Lyman & Co., now Lyman, Clare & Co.

Lots Nos. 18 and 19, leased to Grant, Hall & Co., occupied at present by the Montreal Warehousing Company, without consent of Department.

Dry Dock Lot, &c., leased to G. & W. Tate, sold by Sheriff's sale, now occupied by George Tate, Ferrier & Co. and Mooney & Co.

St. Gabriel water-power, leased to Young & Gould, still in the name of Young & Gould.

An Order in Council, No. 1,144, 11th and 12th October, 1852, gave authority for sale by auction, of the water-power, at Cote St. Paul Lock, it was sold upon the 1st February, 1853, to W. Parkyn, and the lease executed in Aug., 1860. The property was transferred to John Frothingham, without consent of Department, now the estate of John Frothingham,

The loose, and indefinite manner, in which many of these leases were drawn up, has led to disputes, and assumptions, on the part of the lessees.

It is necessary, with regard to the professional gentlemen, who, at the time, would have the authority by their reports, and opinions, to express the intentions of the Government, to have that date fixed.

Professional gentlemen employed by the Government and date of employment.

From December, 1841, until June, 1846, the Hon. H. H. Killaly, was Chairman of Board of Works. Under a new Act, he was Assistant Commissioner until October, 1848, when he was placed in charge of the Welland Canal; he became Assistant Commissioner again in 1851.

During the construction of the Canals there were Engineers over each in an independent capacity; they reported to, and received instructions from, Mr. Killaly, who was an Engineer of ability.

From 1841, until the summer of 1846, Mr. Keefer was Engineer of Board of Works; he was then transferred to the Welland Canal, as Engineer of that work, and

was appointed Engineer of Board of Works in December, 1848, a position he occupied until 1853. He, subsequently, was Deputy Commissioner of Public Works from 1859 to 1864.

During the enlargement of the Lachine Canal, he appears to have had no connection with the Canals, but was engaged upon roads, harbours, bridges, &c., and until placed in charge of the St. Lawrence Canals about the beginning of 1849, had nothing to do with the Lachine Canal. Any connection he had with the leases of water-power was subsequent to 1849.

Mr. Alfred Barrett, who had previously been Associate Engineer with Mr. Power upon the Welland Canal, was transferred to Lachine Canal, as Engineer in charge, in the autumn of 1843.

Mr. Killaly, in assigning him his position, writes:—"Your experience, and fitness, for the duties of this office, render it unnecessary for me to enter upon any recital of them."

On the 27th December, 1848, Mr. Barrett was discharged and Mr. Keefer placed in charge of this Canal. Mr. Barrett had evidently a high reputation as an Engineer. In January, 1847, the Executive Council, being dissatisfied with the Engineering, and Estimates, of the Engineer of the Welland Canal and the reports of the Commissioners with reference thereto, passed an Order in Council in the following language:—"In order to decide the most economical and beneficial course to be taken under the circumstances, and also to procure the fullest information to be laid before Parliament, the Committee recommend that Mr. Barrett be immediately sent up to the Canal for the following purposes,"—then follows a list of various questions of Engineering, and expenditure, to be enquired into, and examinations to be made.

This is cited, to show the position occupied by this gentleman in the eyes of the Government. His reports, and regulations, would represent its intentions with regard to the leases previous to 1849. The method in which he laid off the hydraulic lots, and the amount of water apportioned to each, would be binding, as the only design sanctioned by Council.

Water-power at Basin No. 2.

The principal power upon the Lachine Canal, is produced by the head or fall, between the level of what is called Basin No. 2, Montreal Terminus, and the River St. Lawrence. The average head, or fall, for seasons of navigation, varies from 20 feet 6 inches to 25 feet; during the winter seasons this head, or fall, varies from 11 feet to 17 feet. Mr. Barrett stated the fall would be about 26 feet, and at the ordinary stages of the river in summer 24 feet; at that time there were no data, to compute the averages over a number of years.

The location being favourable for taking advantage of this power, Mr. Barrett laid out twenty mill privileges, a plan of which, made by his assistant Mr. Cornell, is on record in the Department, on the south side of the Basin. To each lot four runs of stone were apportioned, with 360 cubic feet of water per minute for each run, or 1,440 cubic feet per minute to a mill site.

The principal difficulties, as reference to extracts from Reports will show, arose from the quantity of water, to each run of stone, not being specified in the leases. There seems to have been an ignorance of the fact, that the quantity was distinctly defined, at the sale of several of these lots, and in conditions incorporated with the only legal lease upon the Basin.

It is evident, that this defined volume is the legal interpretation of a "run of stone," in so far, as the amount of water Lessees upon this Basin are entitled to, whether the leases were executed previous or subsequent to Mr. Barrett's Engineership.

As far as the past is concerned, these matters cannot effect anything, but become of importance upon the renewal of the Leases, when the same contentions, as made in the past, may be made in the future, and more water claimed than the Lessees have any title to. It is

Quantity of water
Lessees, under their
leases, are entitled
to.

therefore necessary, to deal fully with this phase of the question, in order there may be no misunderstanding as to the rights of the Government and the rights of the Lessees.

On the 24th June, 1861, Mr. Sippell, Engineer in charge of the Lachine Canal, writes to the Department of Public Works for information, in this language:—"I beg to state in making certain statements, required for the Chief Engineer, relative to the supply of water for the mills at Montreal, I find it necessary, if possible, to obtain what amount of water was originally intended to be supplied on each lot, for driving an ordinary run of mill stones, and necessary machinery, as mentioned in the lease, or the number of horse-powers, attached to each lot of four runs of stones, and necessary machinery. As there is nothing in this office, that has any reference to the matter, I beg you will be so good as to supply me the information from your office."

The endorsements upon the document are:—"Find Deputy Commissioner's report, on hydraulic lots Lachine Canal, sometime previous to 1852."

This report could not be found. The Deputy Commissioner makes the following endorsement:—"Inform Mr. Sippell, that the water privileges upon the Lachine Canal, were projected, and arranged, by the present Deputy Commissioner, at the time he was Chief Engineer of the Department. That at the Montreal Basin, a certain number of lots were laid off, and surface water sufficient to propel four runs of stones and machinery appropriated to each..... it was estimated that a discharge of 1440 cubic feet per minute, under an assumed average head and fall of 20 feet, will propel four runs of stones and machinery. The discharge under the assumed head being equal to forty effective or fifty theoretical horse-powers." An official letter copied from this endorsement was sent to Mr. Sippell. With reference to the report that was missing, the Deputy Commissioner on the 16th June, 1863, sent a copy of the report dated 15th January, 1850, in order that it may be placed on record, for future reference, as the clerk in charge of the records was unable to find it. There is no specified amount of water in this report.

At an arbitration, between the Government and one of the lessees, which will be alluded to subsequently, the Deputy Commissioner testifies in evidence:—"I am well acquainted with the line of the Lachine Canal, having myself laid it out, and planned the water-power."

There must be some misconception, as previous evidence shows, the Deputy Commissioner had nothing to do with the planning, laying out, or specification of the volume of water to each lot, which in any way received the sanction of Council, he being at the date of the first lease, Engineer of the Welland Canal, and no Departmental authority. It is evident that the remaining lots, that were leased when he was placed in charge of the Canal, would be bound by the conditions of the first lease.

Why a copy of the Order in Council, with the lease, and conditions, attached, was not sent to Mr. Sippell, does not appear. It would have had legal weight, while what the Deputy Commissioner had, or supposed to have had, estimated some ten years before, is of little value.

It would seem that the 1440 cubic feet per minute was taken from the Order in Council as 360 by four is 1440. Mr. Barrett assumed a head or fall of 22 feet. This letter assumes 20 feet; as the quantity of water discharged, and head, determine the power, the coincidence of the same amount of water for two different heads is remarkable.

1440 feet per minute under a head of 22 feet would give nearly 60 theoretical horse-powers, or two thirds for useful effect, equals 40 effective horse-powers.

In this letter 1440 cubic feet per minute under a 20 feet head, is estimated at 50 horse-power, theoretical, or 40 effective, that is the wheels would give a useful effect of 80 nearly per cent. It is only within the last few years that water-wheels generally, have been constructed to give an efficiency of 80 per cent., and that, more often at a testing flume, than at actual work.

The Deputy Commissioner in 1863, before Arbitrators takes a percentage of two thirds for useful effect, thirteen years before he states he estimated 80 per cent.

There would seem a desire to harmonize Mr. Barrett's 360 cubic feet, 20 feet head assumed by Deputy Commissioner, and 10 horse-power to a run of stone inserted in subsequent leases.

The Deputy Commissioner gave the following evidence before the Arbitrators:—"My first calculation as to water-power available upon Basin No. 2 Lachine was made in 1843. I cannot say whether I at that time converted it into horse-powers. I cannot say when I first assumed a run of stones equal to ten horse-powers. This basis of a run of stones was not I now remember mentioned in any report of mine to the Department. It was not mentioned in any of the leases or conditions, nor am I aware of its having been communicated to any of the Lessees." He afterwards states he remembers he used ten horse-power for a run of stones in a report on the Welland Canal.

This statement is misleading, in 1843 that canal had only a water section of 180 square feet, when Mr. Barrett's conditions were written the enlargement of the canal was nearly completed which would give a section of 1000 square feet. Although the term "ten horse-power," was not mentioned in leases or conditions, it has been shown that the quantity of water, to give that power, was, and that it had been read, at sales by auctions, on different dates, accepted as binding by several Lessees, and incorporated in one lease.

The definition of a run of stones, to be equal to ten horse-power, as inserted in the present leases is nearly as undefined, as far as the consumption of water is concerned, as the "run of stones" in the original leases. The head, which Lessees would be compelled to use, not being stated, they might draw, say double the quantity of water, that would be required, through loss of head. No attention being paid to the class of water-wheels, that were used, they could consume double the quantity of water with inefficient wheels, or altogether four times the amount necessary, and still conform to the term "ten horse-power."

Although there may be some repetition, it is necessary, that all the facts, which bear upon the consumption of water, and the amount these Lessees are entitled to, should be considered.

Indefiniteness of the term "run of stone."

Facts relating to the quantity of water leased at Basin No. 2.

It was the original intention, that the quantity of water should be specified. In a report to Council 14th November, 1844, asking for authority to lease mill privileges, on the line of the St. Lawrence Canals, Hon. H. H. Killaly states:—"Each sale or leasing of water, the Government may decide upon, should comprehend a defined volume of water, and should the purchaser, from time to time, wish to extend his works, he should treat for a further supply."

In the report of Mr. Barrett, 11th April, 1844, he remarks:—"I herewith enclose you a copy of the land belonging to the Board of Works in Montreal, showing some points for the location of mills, shipyards, &c." Speaking of flouring mills, he states: "Each run of stones at this place, will not require more than 400 cubic feet of water per minute." In relation to the water-power created at Montreal by this canal, I am of opinion that there will be 1,000 cubic feet per minute available, without producing a current of more than one-half mile per hour, including the supply for lockage.

Mr. Barrett, in a later report, and conditions, after a description of the lots, he states:—"They will be supplied with sufficient water, calculated to drive four runs of stones, or enough to propel other machinery requiring an equal amount of power. During the season of navigation, the water will be supplied over a waste weir of suitable breadth, (the upper edge of which will be $6\frac{1}{2}$ inches under top water line of canal,) to supply about 350 cubic feet per minute for each run of stones, excepting, at such periods, when irregularities in the level of the basin, (necessarily arising from a rapid succession of lockages from or into it,) may for a time increase or diminish the supply."

In winter the water was to be supplied through sluices:—"There will be two sluices affording a supply, for each run of stone, of about 360 cubic feet per minute, (the same as supplied over the weir,) for each lot, the machinery for which will be

provided, placed, governed, and regulated, by the Department, and will be always under its control."

(Order in Council.)

"The Committee recommend for Your Excellency's approval, the suggestions contained in the report of Mr. Barrett, and that the mill sites be disposed of, under leases of 21 years, subject to the conditions, and restrictions, contained in said report."

In the leases made previous to 1851, when a new form of lease was used, with the exception of the lease approved of by Council, the following clause is omitted:—"That should it hereafter be found, that the said sluices will admit a greater volume of water, than will be sufficient to propel four runs of mill stones, and machinery, the said Lessee shall not be entitled, by this lease, to receive the whole thereof, but the said Commissioners will, (upon receiving the sanction of His Excellency in Council,) grant it upon obtaining the amount of additional rent to be paid." These matters were then considered important, to conform to the act, the sanction of Council was necessary for using any extra water, than specified in the lease.

In March, 1847, contracts, plans, and specifications, were made for weirs, to supply the water, on Mr. Barrett's design to the mills; during navigation over the crest of the weir, and in winter through sluices in the breastwall. Bolted to the coping of the breastwall is a tee shaped iron, the top of which formed the crest of a weir 18 feet wide and $6\frac{1}{2}$ inches deep. Although the form of this weir, does not meet the conditions of ordinary weir formulæ, it would give an approximate discharge of 1,440 cubic feet per minute. These weirs were built, and the design accepted, when it became necessary to supply water to other lots, by the succeeding Engineer, I find his name attached to direct copies of these plans, and specifications, with the only change, he did not see the necessity of sheet-piling, which was done away with, and has since caused considerable expense, it having to be sheet-piled, to prevent leakage, and destruction of the walls.

The plans, attached to the final estimates of these contracts, differ from the contract plans, instead of the iron crest of a weir, there is a timber substituted, bolted to the coping of the breast wall, and of a height sufficient to fill the space, between the top of the breast wall, and level of water. Who was responsible, for changing the system approved by the Council, for supplying the water over a weir during the season of navigation, does not appear. By this change, the mills could draw all the water that would flow through the sluices; it destroyed the only effectual protection to navigation; it deprived the Government of a large revenue; there was no water for several lots, and the extra amount drawn was not paid for; it has led to that condition of things portrayed in the Departmental records.

The Deputy Commissioner in evidence before the arbitrator states:—"It was originally intended by me to supply the mills by weirs over the wall, which would have placed the Canal entirely beyond the control of the lessees; but this would have proved impracticable on account of frost." How frost would affect the flow of water in the summer is not apparent, as the water was to be supplied through sluices in winter.

The first report to Council by the Chairman of the Board of Works, having laid down the principle that: "Each sale or leasing of water should comprehend a defined volume of water," that volume has now been clearly substantiated; it was specified by Mr. Barrett; it was adopted by Council; it was made a condition in the only legal lease, that a run of stones at Basin No. 2, Lachine Canal, was granted 360 cubic feet of water per minute, or 6 cubic feet per second.

It is necessary to refer to the evidence, and reports of hydraulic engineers, given on behalf of one of the Lessees, found in the records of this arbitration, which the Commissioner of Public Works states in 1863 was to settle all disputed questions.

It is probable similar evidence might be again advanced, in any dispute between the Government and Lessees.

Two engineers were employed to calculate the discharge of water at Basin No. 2, and the amount of water a "run of stones" was entitled to.

will be always

the suggestions proposed of, under in said report." was used, with e is omitted:— greater volume and machinery, sole thereof, but lency in Coun-." These mat- of Council

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r at Basin No.

The data upon which these calculations were made, were the measurements of Mr. Sippell taken in October, 1860, for the purpose of estimating the consumption of water.

In May, 1862, clippings were sent to the Department, from the *Montreal Herald*, of a correspondence between Mr. Ira Gould, one of the lessees, at Basin No. 2, and Mr. Charles Legge, C. E., which had been published in that paper. The Hon. John Rose, M.P.P., also forwarded a letter from Mr. Gould to himself.

Mr. Legge is requested to furnish Mr. Gould with "a statement, which will show the quantity of water that will pass, in a given time through the openings which supply the water for a run of stones at Basin No. 2, Montreal."

Mr. Legge replies:—"I find on calculation, based on data furnished by the Department of Public Works, that the quantity of water used by three flouring mills, Grant, Hall & Co., McDougall, and Ira Gould, amounts to 951 cubic feet per second, which, divided by 24 runs of stones, the number leased by the Government to the above proprietors, will give for each run a discharge of about 39.62 cubic feet per second. I may also state that the discharge at all the existing establishments at the same point (Basin No. 2), amounts to 2,053 cubic feet per second, and that were all the water used, which is actually leased, the discharge would be augmented to about 2,511 cubic feet per second."

In the letter to Mr. Rose from Mr. Gould, he states:—"The facts contained in Mr. Legge's answer are now as well known to the Engineers of the Department of Public Works, as they are to Mr. Legge and myself. Leaving the other Lessees out of the question, how did this evidence affect Mr. Gould? He was present at the original sale of the lots, and purchased them upon the condition, that six cubic feet per second would be allowed to a run of stones (auctioneer's certificate). His lease contains these clauses: "Subject, however, to the conditions hereinafter mentioned, part whereof were read over, and agreed upon at the time of sale, and the supply of water thereto is granted, and such parts of the conditions of public sale, as are repugnant hereto are hereby rescinded, and such other parts as are not hereby rescinded are to remain in force;" also: "That should it hereafter be found that the said sluices will admit a greater volume of water, the said Ira Gould should not be entitled by this lease to receive the whole thereof."

"That should the said Ira Gould be desirous of obtaining the whole of the water-power, that can be supplied through the said sluices, the said Commissioners will, upon receiving the sanction of His Excellency in Council, grant it upon determining the amount of additional rent to be paid therefor." He is in the position of acknowledging, over his own signature, at the date of this letter, to have violated the terms of his lease, by having been using six times as much water as it entitled him to, and to have deprived the Government of the additional rent, that the lease provides should be paid, when he had obtained the sanction of His Excellency in Council (which was never obtained), to use more water.

Mr. Gould's lease entitled him to 12 runs of stones. He was using 79 runs of stones, or 67 runs more than leased.

The value of a run of stones, to be obtained from Lessees, by order of the Department of Public Works, was in 1850, £12 10s. The Government were losing yearly \$3,350.00 in revenue, according to his own statement.

In May, 1863, Mr. Legge gave in sworn evidence, before the arbitrators, on behalf of the claimant, Mr. Gould, a similar statement to that previously referred to. He says:—

"The calculations in Exhibit were made by me, and the results are correct showing a total of 2,052 cubic feet per second, of water, passing through the openings, at the works on Basin No. 2 of the Lachine Canal."

The definition of a run of stones is arbitrary, the same as horse-power; a run of stones at the Basin No. 2, uses 39.62 cubic feet per second.

A Report to the Hon. John Young, and Ira Gould, by James B. Francis, Esq., C.E., the distinguished Hydraulic Engineer, of Lowell, Mass., was filed as evidence for the claimant. That gentleman made similar calculations to Mr. Legge. He

states in his report:—"By the preceding table, it appears that the water wheels supplied from Basin No. 2, when their gates are fully open, have the capacity of drawing 2,005.73 cubic feet per second."

"If I am correctly informed, the amount of power or quantity of water, to which a run of stones at Basin No. 2 is entitled, is defined only by what was necessary for the purpose when the grant was made. (That has been shown to be six cubic feet per second, a fact which Mr. Francis was not acquainted with). I have not been able to find that it has been estimated anywhere, what amount a modern flouring mill requires. Until this is done, and *presuming that all parties have acted in good faith*, the only mode open to determine it, *ad interim*, appears to be, to take, what the lessees have actually done under their leases. Adopting this method, I find the quantity of water required to drive "a run of stones" at Basin No. 2 as follows:—

I learn that all the water drawn from Basin No. 2, at Lots Nos. 11, 12, 13, 14, 18, 19 is used in driving twenty-four "runs of stones." The quantity of water the wheels on these lots are capable of drawing, is, by the preceding table, 927.52 cubic feet per second, or at the rate of 38.65 cubic feet per second per "run of stones."

Walter Shanly, Esq., C.E., gave evidence on behalf of the claimant. He stated that the Report B. (by James B. Francis, Esq., C.E.) had been examined by him, and verified:—"And that about 40 cubic feet per second are considered, commonly, equal to one run of stones, there is no regular rule to go by. I am in the habit of assuming that as the quantity."

When evidence of this kind is adduced, it is necessary to enquire, what could be claimed, and substantiated, in a Court of Law, as the amount of water or power required for a "run of stones," without reference to conditions and intentions, but judged solely, by what the phrase, "water to propel an ordinary run of mill stones," means. It is well known that from experiments made with average descriptions of wheat, it

Quantity of water to a run of stones that could legally be substantiated.

has been found, it requires less than one horse-power, to grind one bushel of wheat in an hour. One horse-power is the general standard.

If the average number of bushels an "ordinary run of stones" grinds per hour in Montreal, or elsewhere, is determined, the power required per run of stones is established.

There was, at one time, a period of fast grinding in America, which was abandoned on account of the poor flour manufactured.

At Montreal Mr. Gould grinds from 8 bushels to 15 bushels per hour. The larger quantity would be a selected description of wheat. At the extensive mills of Mr. Ogilvie, before they adopted another process of manufacture, they ground 4 to 6 bushels per hour with a run of stones, or an average of 5 bushels. The millers of Mr. McDougall state they grind on an average seven bushels.

The *London Miller* publishes a table, compiled from the opinions of the most successful engineers and mill-wrights, which gives as the best results for stones 4 ft. 6 in. diameter, 105 revolutions per minute, $4\frac{1}{2}$ horse-powers, and 5 bushels of wheat ground per hour.

Pallet states in his book, "Miller, Millwright and Engineer":—"A great oversight by millers is grinding too fast. A 4 ft. 6 in. pair of stones, making 150 revolutions per minute, ought to grind not more than 10 to 12 bushels of wheat per hour." In order to grind this amount it requires 45 revolutions per minute more than the practice of the best engineers and millwrights in Great Britain.

Six bushels per hour would be a fair average, or six horse-powers to a run of stones.

Leffel & Co., who claim there are 10,000 water-wheels, of their manufacture, in operation, who have an extensive knowledge of the power, required in mills, in the United States and Canada, by means of their business, have informed me they usually estimate for a run of stones grinding 6 to 8 bushels per hour, a power of 10 or 12 horses.

The editor of the "Milling World" states:—"That the custom among the lead-

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ing milling engineers, is to provide power for each run of stones, with its complement of cleaning, elevating, bolting and purifying machinery, to the extent of $1\frac{1}{2}$ horse-power per each bushel of grain ground per hour. Instances are to be found where the work is performed with a consumption of one-third less power than this, but the custom is as we state."

Sir William Fairbairn designed, and constructed mills, to grind 5 to 6 bushels of wheat per hour, and allowed one nominal horse-power per bushel in designing the engines.

Jackson, in "Manual of Hydraulics," gives four horse-powers, nominal, for a run of stones.

Hughes, in "The American Miller, 1855," and Pallet, in the work referred to previously, publishes a table, giving, for the head at Basin No. 2 (22 feet), the number of square inches of water necessary to propel a run of $4\frac{1}{2}$ feet mill stones, as 43 square inches, or a discharge of some 6 cubic feet per second and a power of 6 horses.

In the different advertizing pamphlets, of water-wheel manufacturers, there are published testimonials from persons using their wheels, in which the number of runs of stones the wheels are impelling, their size, and the head, acting upon them, are stated.

I have found, that in eleven merchant mills of from 4 to 10 runs of stones, the average power was 11 horses to the run; and in forty mills from 1 to 3 runs it was 10 horses. This power is calculated from the tabulated power of the wheels, as given by the manufacturers themselves. It is well known they exaggerated the power their wheels will give, and that millers in purchasing a wheel will procure a size, that will afford power in excess of what would drive their machinery, in cases of backwater and their contingencies. For these reasons 10 per cent. would be a small deduction, which would give 9 to 10 horse-powers for a run of stones in 51 mills in actual operation.

Mr. Gould, a practical miller in the sub-leases of the St. Gabriel Water-Power Co., leased, for a run of stones, 150 square inches of water, which, under the head at this lock $8\frac{1}{2}$ feet, would be nearly 10 horse-powers, although he claimed much greater power at Basin No. 2, where the Government was Lessor.

In the leases it is generally specified, that the water-wheels shall be of the most improved description at the time of erection. In 1837 there were turbines which gave 70 per cent. to 75 per cent. of the theoretical power of the water. At the date of these leases, both in Europe, and the United States, there were many water-wheels giving an average useful effect of 75 per cent. For the following calculation, assume two-thirds for useful effect as the probable percentage taken by Mr. Barrett:—

$$\frac{62\frac{1}{2} \times 6 \times 22 \times \frac{2}{3}}{550} = 10 \text{ horse-powers.}$$

It has now been proven beyond doubt, in whatever view it may be taken, that the Lessees at Basin No. 2, have only right, and title, to six cubic feet per second to a run of stones, or 10 horse-powers.

First,—Mr. Barrett's conditions, adopted by the Governor in Council and unchanged.—Cubic feet per second..... 6.00

Second,—By the average number of bushels of wheat ground per hour at Montreal, and elsewhere, by a run of stones and the power required for that purpose.—Cubic feet per second 6.00

Third,—Pallett, Hughes, the "London Miller," Leffel & Co., the Editor of the *Milling World*, Sir William Fairbairn.—Cubic feet per second not more than..... 6.00

Fourth,—Fifty-one flour mills in operation.—Cubic feet per second..... 6.00

In opposition to this we have the evidence brought forward at the arbitration.

Mr. Legge.—Cubic feet per second.....	39·62
Mr. Shanly (always assumed).—Cubic feet per second.....	40·00
Mr. Francis (non-committal) do do	38·65

The calculation of the discharge of water, through the wheels of the mills, on this basin, was, as before stated, made from measurements taken by Mr. Sippell in 1861, of the throats, or apertures, that admitted the water to the wheels. Any calculation, as is well known, by anyone acquainted with the uncertainty of the science of hydraulics, is very approximate. The only accurate methods would entail greater labour, and expense, than necessary in a preliminary investigation, but which would be required if the Government take any action with these lessees, and adopt the scientific systems of other countries.

Measurements, similar to Mr. Sippell's can only be taken in summer, as in winter the backwater is over the wheels. Rather than delay this report I have taken the measurements of Mr. Sippell, and ascertained by enquiry from the lessees, the changes made in the interval. With the exception of a few new wheels, chiefly Leffel's, the same conditions obtain; in thirty years there has been little improvement, the same water-wasting and inefficient wheels, demonstrating something wrong in the system, that in the

Few improvements in hydraulic motors at Basin No. 2 in twenty years.

heart of a city like Montreal, where power should be valuable, water-wheels of this description should still be in existence.

I have found, from data obtained in the manner stated, that the wheels from the Basin No. 2, have a capacity of discharging about 2,114 cubic feet per second. The actual discharge can only be obtained by measurements. A detailed list of these wheels, apertures, &c., is appended.

Capacity of discharge from water-wheels Basin No. 2.

Mr. Legge's, and Mr. Francis', calculations from measurements, taken in 1861, were respectively 2,052 and 2,005 cubic feet per second.

We will assume that the wheels have a discharge of 2,000 cubic feet per second, a few cubic feet per second is immaterial, considering the disregard and apathy that have characterized the administration of these water-powers; but of importance when the power has to be paid for, as six cubic feet a second, represents a rent of \$50 per annum, at the prices established by Order in Council some thirty years ago.

The reason, which caused the amount of water used upon Basin No. 2, to come so prominently before the Arbitrators, was, the Lessees of the entire power at St. Gabriel Lock were prevented from subleasing more water by the Department, this lead to disputes, and litigation, direct, and indirect, damages were claimed from the Government, the lessees endeavoring to prove by the calculation cited and other evidence, that a greater quantity of water was drawn from the canal by the mills at Basin No. 2, than subleased at St. Gabriel, consequently they were not using the entire surplus water, and the Department was not justified in refusing them the water.

The contentions of Mr. Sippell, the Engineer of the canal, at this arbitration, were, that although the wheels might give this discharge, there was not that amount of water used, nor could it be forced through the canal, without creating a current, that would render it unnavigable, also that the estimate was exaggerated. Mr. Sippell in his evidence reduces the discharge to some 1,650 cubic feet per second. This quantity must be indefinite, they certainly drew from the canal, as much water, as the mills at St. Gabriel, used, 1,200 cubic feet per second.

They had, by their leases, the right to use 360 cubic feet per second, which would be 840 cubic feet per second, or 140 runs of stones more than they were entitled to, and paid for.

Take a period of twenty years, down to the date of the commencement of the enlargement, 140 runs of stones, at the Government price of \$50.00 per annum, would give \$7,200 a year, the country was losing, or \$144,000 in the twenty years,

over one-half, that has been received, in rents from the lessees on this Basin, from the commencement of their leases, some thirty years, the sum of \$215,905.

St. Gabriel Water-Power.

This lease, the granting of which has been referred to previously, is a one-sided document throughout; in addition to a clause of the conditions, drawn up by the Engineer, there is added a guarantee, "the extent of power being considered not less than twenty runs of stones;" and in the general renewal clause of the Government leases, there is inserted, "the amount of rent to be charged in the renewal of this lease shall not be estimated at more than what would be equal to twenty runs of stones, which if the lease would not bear the interpretation placed on the phrase, "surplus water arising and flowing," subsequently, would bind the Government, if this lease is sustained, to charge no more than for twenty runs on the enlarged canal. The effect of which is the Lessees purchased and pay rent for 280 cubic feet of water per second, they sub-leased 1,200 cubic feet, 920 of which the Government should have rent from; by the enlargement, if the supply is increased, to 2,400 cubic feet, the Government bind themselves to renew perpetually for a rent of twenty runs of stones, or 280 cubic feet, the remaining 2,120 cubic feet, being still the property of the Lessees to be sub-leased for their profit.

In another stipulation the Government were bound, if for any public purpose, the whole surplus water, or any part thereof, was required, that any buildings, or fixtures, which may be in anywise connected with the use, or occupying, of the surplus water whether upon the land leased from the Government, or on land bought by the lessees for the utilization of the power, that the present value with ten per cent. added should be paid for all buildings and fixtures. The absurdity of this stipulation is evident, the Government are to receive a rent, for all time, equal to twenty runs of stones, there were in the past, say twenty runs utilized upon Government property, the other sixty odd, sub-leased, were utilized upon land bought by the Lessees, if for any purpose this water was required, or if, in the enlargement, it had been necessary to supply it at a different part of the canal, the Government had, themselves, to pay for all buildings, and fixtures, whereby this water was used, whether on their own property, or that of the lessees, they never receiving one cent revenue from it, assuming all the risks, and the Lessees deriving all the profits.

Messrs. Young & Gould, in order to utilize the sixty odd runs of stones more than they were entitled to, purchased property adjacent to the canal for £2,900 10s. On the 13th February, 1852, two deeds were executed between Messrs. Young & Gould and De Witt & Ostell.

The first conveyed to DeWitt & Ostell, one-half the land bought upon the payment of one-half the purchase money.

The second conveyed an undivided half interest in all the Government land and surplus water leased by Messrs. Young & Gould for the sum of £10.

On account of the expense, attending the purchase of land, and the utilization of the water, a deed of partition was drawn up dated 12th June, 1853, dividing, and apportioning the property, and power, among themselves in four parts, with certain charges and monies upon each division: The land divided was:—

First. Land belonging to the Government, more or less.

Second. Land conveyed to the Government by deed of purchase from "Les Ecclesiastiques du Seminaire de Saint Sulpice."

Third. Land purchased by themselves from the same parties, amounting in all to £2,900 10s.

The whole property is divided according to a plan attached to the deed.

The water-power was apportioned in the following manner, to the four divisions of the property :—

Division No. 1, John Young,	Runs of Stones,	20 square inches water.	3,000
do 2, John Ostell,	do do	22 do	3,300
do 3, Gould & DeWitt,	do do	24 do	3,600
do 4, do	do do	28 do	4,200
Total.....	do do	94 do	14,100

The difficulties, between the Lessees and Department, which resulted in the unsettled Arbitration so frequently alluded to, arose from the undivided half of Messrs. Gould & DeWitt, represented by Mr. Ira Gould.

Arbitration between
Mr. Ira Gould and the
Government

The right, of the Department to construct a lock keeper's house, a weir, and a street, at the situations chosen by the Engineer in charge of the canal, was disputed. Mr. Gould leased, as a hydraulic lot, the ground upon which the lock keeper's house was situated, the sub-lessee proceeded to fence in property required for canal purposes. The Department interfered, and prohibited this action, upon which litigation between the sub-lessee and Mr. Gould ensued.

A large amount of correspondence took place between Mr. Gould and the Department, frequent references were made by the Department to Law Officers of the Crown, as to his right under the lease.

Mr. Gould eventually sent in a bill of damages against the Government. One item is damages for interfering with water-power and land leased to William Walker \$1,800. The Department for canal purposes used a strip of Government property for the formation of a street. The item of damages, for the land required, was \$25,000.

The water-power, upon the divisions of Young & Ostell, had all been sub-leased, which had been apportioned to them by the deed of partition. Gould & DeWitt had leased within 1050 square inches of their complement, 600 square inches were then leased to one Green, who erected buildings for manufacturing purposes. Without the sanction of the Department, he commenced cutting the banks of the canal, to put in a flume, or pipe, for drawing this amount of water from it. Navigation, was, and had been, suffering from the great quantity of water used by the mills, the Superintendent of the Canal was ordered to stop the cutting through the bank. This action directly effected Mr. Gould's interests, as he had signed the deed of partition, apportioning the quantity of water to each, the other two divisions had their amounts sub-leased, these 1,050 square inches of the water, assigned to him by the deed, the Department would not permit him to use. With this fact the Government had nothing to do, if these Lessees divided 78 runs of stones more than they had purchased amongst themselves, it was their own affair, and loss. Mr. Gould with a force of men then undertook the work of cutting the banks, he was ordered to stop by the Superintendent, but persisted until he was arrested under a warrant and held in bail for some six weeks. Mr. Sippell reports upon this item :—"Sixth item is for personal damages, for false imprisonment, &c., &c., amounting to \$10,000. Notwithstanding the refusal of the Hon. the Commissioner, to grant Mr. Gould's oft repeated application, to cut the canal bank for supplying water to Mr. Green, as above stated, he was not satisfied, but taking advantage of the season when the water was drawn out of the canal, for repairs, in the month of April last, he set the Government at defiance, and commenced cutting the banks, when he was warned off by the Superintendent, and the cuttings he had made in the banks filled up by him, for which Mr. Gould attempted to get him arrested, but failed in getting a warrant for the purpose. A few days after, Mr. Gould again commenced cutting the bank, and was again warned off by the Superintendent, which he refused to do, unless he were overpowered. Application was made to Mr. Coursol, Judge of the Police Court, who issued a warrant for the arrest of Mr. Gould, and his men, on which Mr. Gould and as many of his men as

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Mr. Green then had action of damages, against Mr. Gould, for non-supply of water, and indirect losses upon the buildings he had erected.

Mr. Gould's claims, against the Government for this action, were:—

Items Nos. 1 and 2, withholding water from Green & DeWitt	\$3,150 00
Item 3, damages claimed by N. O. Green.....	8,500 00

This water was refused, as those navigating the Canal, and sub-lessees of Young & Gould, complained to the Department about permitting more water to be sub-leased, a document was sent to the Department, which was addressed to the other sub-lessees by a sub-lessee. He protests against any more water being leased by the Hydraulic Co., the effect of their leasing the 600 square inches would rob each of the sub-lessees 5 per cent. of what they had leased, as there was no more water to supply it; he, in strong language, calls upon his co-lessees, giving figures to justify a petition being sent to the Board of Works, to have the quantity of water drawn from this level, looked to by them.

None of the claims of Mr. Gould were recognized by the officials of the Department, they were investigated, and decided against, by the Commissioners of Public Works. Mr. Gould succeeded in having his claims referred to the Provincial Arbitrators by a subsequent Commissioner. The Arbitrators met, and adjourned several times, there were filed in the case some seventy documents as "exhibits," fifteen witnesses were examined for the claimant, and fourteen for the respondent, among them were five Civil Engineers, a number of forwarders, navigators and mill-owners. Previous to the arbitration, one hundred and thirty-five letters were received or sent by the Department on the subject. The Arbitrators adjourned for further evidence, and never met again on these claims, consequently they are still in abeyance, and the objects of this arbitration, as stated in the report of the Commissioners of Public Works, have never been attained. One of the remarkable features of this arbitration, is the ignorance or suppression of the report, regulations and conditions of Mr. Barrett, it was not filed as an exhibit, or alluded to in evidence, it would have destroyed the evidence of Engineers, and others called for the claimant, and settled other matters, which the Commissioner of Public Works states, in his report of 1861, were the principal cause of injury to the interests for which the canal was originally constructed.

In this case, there never was the foundation of a claim, either in equity, law or justice.

To return to the lease, the clause granting the water, reads:—"Together with the use, and enjoyment, of the entire surplus water, disposable, arising, and flowing, from the level of the said Lachine Canal, at and above St. Gabriel Lock." The Chief Engineer in his report of December, 1850, recommends the sale of five mill lots, and twenty runs of stones. In his report, purporting to be made a month afterwards, he changes his opinion,—“Certain parties at Montreal desirous of purchasing *all* the surplus water disposable at St. Gabriel Lock, it is respectfully submitted, no objection presents itself to carrying out such an arrangement, providing the following conditions be complied with.” In these conditions there is no clause of limitation.

The Deputy Commissioner in examination before the Arbitrators states,—“The computation of water-power, made at the time of lease, was a maximum of 36 runs of stones, but I did not consider it safe to recommend over 20 runs.”

Whether the legal interpretation of this phrase “arising and flowing” from the level above, is determined to be, the amount of surplus water at the date of the lease, or the amount that will be flowing during the tenure of the lease, twenty-one years, and by its renewal clause, perpetually, without reference to any changes, whereby the conditions are entirely different, from those at the date of lease, and the

Quantity of surplus
 water at date of lease.

supply having been greatly increased. . . If this lease is renewed, as the Government have bound themselves, to charge for only twenty runs of stones, and if the Lessees are only entitled to the amount of surplus water at the date of lease, the position would be on the renewal, they would be entitled to twenty runs, the amount available, above this, at the present time, belongs to the Government, from which they should receive the rent.

The quantity of surplus water flowing at the date of lease,—Mr. Barrett's estimate of surplus water was 15,000 cubic feet per minute previous to the date of this lease.

The Engineer of the Department estimated 39,600 cubic feet per minute, as the quantity that would flow through the rock cut, the narrowest part, without creating a current of more than three-quarters of a mile per hour, from this he deducted 8,000 cubic feet per minute for lockages, &c., making 31,600 cubic feet per minute, or 527 cubic feet per second, as surplus water, available for mills. The basis of this calculation was the quantity that would pass through the rock cut with the current stated, which was an error, the key of the supply of water was the amount that would flow into the canal, through the openings for supplying the canal at the lowest stage of the water in the river. Taking the head, or difference of level between the canal and the river, at one foot although it has been less, these openings, at that date, had an area of 64 square feet, which would afford a supply of 342 cubic feet per second, or deducting the quantity assumed by the Engineer of the Department for lockages and leakage, would give 208 cubic feet per second for surplus water against 527 cubic feet per second as calculated from the discharge through the "rock cut." In support of which Mr. Sippell states in his evidence before the Arbitrators:—"At low water in August, 1851, the supply was reduced to 262 cubic feet per second."

At Basin No. 2, the mills were probably using more than this amount, but we have at the date of this lease, six other mill privileges leased, there being no water to supply them, the result of which is shown, in the extracts from the reports of the Commissioners of Public Works.

In support of this contention the Report of the Commissioner of Public Works, dated June, 1851, states:—"The old locks at Cote St. Paul and St. Gabriel have been converted into waste weirs, for the purpose of effectually regulating the water, with the view to the safety of the canal and the due supply for hydraulic purposes. All the disposable water at the Montreal terminus, and at St. Gabriel, is now leased, and by the time the necessary erections, and machinery, are prepared, much more enlarged means must be afforded, to ensure a steady and ample supply to the mills without affecting navigation." This report is a contradiction, there was no disposable water until the area of supply at the head was increased. The surplus water, at low water, could not have been much over 208 cubic feet per second or 14 runs of stones at St. Gabriel, therefore the amount they paid for, twenty runs, was all the surplus water at the date of lease.

If the interpretation could be placed on this lease, that the Lessees had no right to the extra surplus water, that these enlargements, and additions, to the canal, afforded, that thereby the term level of the canal above St. Gabriel was changed, it not being the same level, the Government have been losers, during nearly the whole period of the lease, granting it to have been legally executed.

The changes, that have been made in the canal, to give an increased supply to the mills, and to regulate it, are these. It has been before stated that the area of openings for supply at the head, at the date of lease was 64 sq. feet, a new weir with an additional area of 168 sq. feet, and another with 336 sq. feet, were constructed, or an increased area of 504 sq. feet; the pier at the entrance was extended which raised the level of water, and the

Changes and erections
necessary to supply
the mills with water.

present works, now being constructed, will still further increase the head at the guard lock; the level of the canal was raised at the guard lock, six to ten inches, to create a velocity sufficient to pass the quantity of water used by the mills, this was done without authority from the Department, and damages were paid for injury to

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lands therefrom; the "rock out" was enlarged, or the water section of the canal increased, from 600 sqr. feet to 1,000 sqr. feet; waste weirs, for regulating the large quantity of water flowing through the canal, were constructed at various times. These works commenced immediately after the date of lease, if under the legal reading of the lease, they were entitled to this increased supply, they are entitled to the increased supply from the enlargement, which would not be common sense. It has been proved, that at the date of lease, all the surplus water was not equal to twenty runs of stones, that twenty runs of stones were purchased, and rent for that quantity paid from the commencement, that the Government by direct expenditure for the purpose, increased the supply above that amount, that the "level of the said Lachine Canal above St. Gabriel lock," was changed thereby, it was not the same canal, that the lease grants the surplus water, arising, and flowing from the level as it existed at the date of lease; therefore, the Government have for twenty-five years been entitled to rent for the amount of water, above twenty runs of stones, sub-leased.

By the deed of partition, the Lessees divided among themselves 94 runs of stones, which they would have sub-leased, if not stopped by the Government. In 1862, Mr. Legge measured the sluices leading to the water-wheels, the discharge was given equal to 88 runs of stones. Mr. Gould, in a letter to the Department, dated July, 1862, states that 87 runs had been in use for some years, that is 67 runs the Government should have received rent for, or at £12 10s. would give an annual rental of say \$3,350, or for a period of twenty-five years, \$83,750. To this amount must be added the ground rent of the land, taken by the lease above the five lots paid for. There have been paid some \$50,000 in damages to sub-lessees, on account of the enlargement, and the representatives of Young & Gould have a claim for land taken for the same purpose.

The total revenue, received, down to 1882, was \$46,060. This lease has been an unprofitable transaction to the country, from its inception.

Cote St. Paul Water-power.

At this lock, five mill-sites were designed, and laid off at the same time as those at St. Gabriel. They were to be sold at the same date, 14th February, 1851, for some reason they were not. On the 13th May, 1851, Mr. John Young applied for this privilege, the Secretary replied, the Commissioners of Public Works were ready to lease it for £450 per annum. A lease was not executed. Another party made application, a report to Council, 6th October, 1852, was made for authority to sell, by public auction, these hydraulic lots. Why this Order in Council was required in 1852, and not in 1851, when they were to be sold on the same date as the St. Gabriel property, does not appear.

These lots were sold upon the 1st Feb. 1853, at an upset price of £400, the Secretary was notified by telegraph the same day, that the lots had been sold to Mr. Parkyn at five shillings above upset price. The same auctioneer sold the property at St. Gabriel, but no official notice from him, of that sale, can be found in the Department.

There has been no trouble with this lease, there never being as much water used as at St. Gabriel Lock.

At the date of sale there was little more surplus water, than at the date of the St. Gabriel lease, if the contentions advanced with regard to it are correct, this lease is only entitled to 20 runs of stones, there were leased at one time some 70 runs, there is not that amount in use at present. If this 50 runs had been leased by the Government it would have returned a revenue of \$62,500 in twenty-five years.

Expenditure for Water-powers.

The principle has been asserted, in the commencement of this Report, that these water-powers were not a necessary attendant upon the construction

No surplus water upon a canal constructed purely for navigation.

of a navigable canal, what has been cited is sufficient to prove this. The creation was made by the Lessees, or the Department, who leased water that was not available, they drew upon the canal to that extent; to preserve navigation and keep the canal navigable, works had to be undertaken from time to time, to supply the water required for navigation, and what was leased, together with the large quantity used above what is leased. It is clear, in the design of a canal for navigation, the amount of water required to be admitted at the head, and flow through the canal, would be the amount required for lockages, leakage, evaporation, and filtration. Theoretical calculation might be made what this amount was, as, the data for this subject has been taken from records in the Department, we will adhere to this, and take the quantity assumed, by the Deputy Commissioner, 8,000 cubic feet per minute, and add 1,000 cubic feet per minute for safety which would give 150 Cubic feet per second. All structures, at the head, and between the levels at the locks, or on any portion of the Canal, that were built for the purpose of admitting and passing a greater quantity of water than this, or became necessary to prevent fluctuations, in the levels, caused by the excess, over this amount, used by the mills, are are directly chargeable to the water-powers. Surplus water, is therefore a misnomer, as applied to the water used by the mills, which may be called water for power, rendered available by a direct expenditure for that purpose, although ostensibly for navigation.

Surplus water flowing through a Canal for navigation could exist in two ways:—

First,—If, the feeders of the canals being designed for the greatest amount of traffic that could possibly pass through it, there was in reality only a third of that amount, or only 50 cubic feet per second required, the remaining 100 cubic feet per second would be surplus water.

Second,—The feeders would be designed to give this 150 cubic feet per second, at low water in the river, at higher stages of the river, a greater quantity would pass through, which would vary with the head, the amount above this 150 cubic feet per second, that would enter the canal would be surplus water, which could be leased to mills, they in seasons of low water would have to close down.

It has been before stated, that at the leasing of Feb. and March, 1851, there was in reality no surplus water, and immediately afterwards it became necessary, to maintain the navigation of the canal, to expend money.

Direct expenditure for hydraulic powers.

In August, 1851, a contract was entered into, for weirs and flumes, to control and pass around the locks this mill water at a cost of \$3,540. A second weir was constructed upon Basin No. 2 for \$10,944.

In 1854, a supply weir was placed in contract at \$27,900.

The mills kept drawing more water, than could pass through the openings at Cote St. Paul, until it culminated in 1861, when 530 vessels were detained. A contract was made for a new weir at \$16,851.

The current was so strong at Cote St. Paul that a pier was constructed to protect vessels, \$2,000. The supply of water at the head becoming short in low water, the Lessees began to agitate the construction of another supply weir. They offered to advance money to be deducted from the hydraulic rents, for the construction of this weir. This proposition was not accepted, the weir was constructed in 1870, at a cost of \$25,173. We have therefore a total expenditure, due to these mills, of \$86,408.

In addition to this, there was a direct expenditure, upon walls, weirs, and flumes, in front of the hydraulic lots, Basin No. 2, of some \$23,474.

Mr. Sippell stated, that on this canal, the increased cost over other divisions of the St. Lawrence Canals in maintenance and repairs was caused by the large quantity of water drawn by the mills. It is impossible to arrive at this yearly expenditure at the present time. On the Beauharnois Canal, 11½ miles long, with nine locks, over a number of years there was an average expenditure per year of \$7,432, for

repairs, and maintenance. The shorter canal, the Lachine, $8\frac{1}{2}$ miles long and 5 locks, the cost for the same period was \$16,566. Although the Beauharnois Canal is longer and has more locks, this comparison would be unfair, on account of the greater traffic upon the Lachine Canal, and the number of wharves, basins, &c., that have to be maintained. Allowing double the cost there would be \$1,700 remaining, we might probably take \$2,000 a year as chargeable to the mills, or for a period of twenty-five years down to the present enlargement, would give a total of \$50,000. A summary of these expenditures and the loss of revenue would be :—

Basin No. 2, Direct.....	\$ 23,474
do do Water not paid for.....	141,000
St. Gabriel, Above 20 runs	83,750
do Damages on account of enlargement.....	50,000
Cote St. Paul, above 20 runs	62,500
General expenditure on structures.....	85,408
Maintenance and repairs.....	50,000
Total.....	500,132

To be added to this, are the losses to those navigating the canal, from the fact of its being converted into a mill race for a great number of years. These figures are in round numbers, to illustrate the principle, set forth in the commencement of this report, disabusing a prevailing idea, that the mills are using water, a necessary attendant upon the construction of the canal, something that would run to waste in any case, and costing nothing, while in reality, the general community have been taxed to present these Lessees with power, and they have, likewise, been permitted to be a serious detriment to navigation.

Proposed System for the Enlarged Canal.

The elements, which govern this investigation are two. A canal being designed solely for navigation, there are no water-powers; the levels between the locks are still water reaches with the almost imperceptible current through them necessary to supply the lockages, &c. On the other hand, there is the canal designed for both water-power and navigation, under this category, although not by design, may be placed the Lachine Canal, for, as has been shown, by the encroachment of the mills upon navigation, works were, from time to time, constructed, which has rendered available a large water-power.

As has been done elsewhere, a private company constructing this canal, where there is an abundance of water, would obtain the largest revenue from it possible, and design it for both purposes. It has now, to be decided, upon what principle the enlarged canal is to be treated, whether the Government decide, to obtain a revenue from the full power that can be obtained, or to make it practically a still water canal, and restrict the Lessees to the amount of water leased, some 360 cubic feet per second. If the former, the question arises, what is the maximum power available upon the canal?

As will be found, subsequently, on the old canal, the principal difficulties arose, not from the current in the main body of the canal, but where the section was contracted, or where structures had not been designed, to pass the quantity of water used by the mills. It has, then, to be determined;—first, the current permissible in the canal;—second, whether this current would become detrimental at any points in the canal;—third, whether the apertures, at the head admitting the water to the canal, will supply the quantity of water that is designed to flow through it.

As was shown in the report upon the Cornwall Canal, it was not the current in the reaches, that was prejudicial, but currents, near the locks, normal to the axis of the canal, caused by the bad location of weirs and races.

Currents in canals.

Upon the old Lachine Canal the bridge piers contracted the

section, and were difficult to pass through; at one time, at the "rock cut," the sectional water area, was only 600 square feet, and when enlarged, was 1,000 square feet, the canal now has a sectional area of 1,950 square feet or nearly double. It has been quoted, previously, from Commissioners Report 1861, that the current in the canal, was from two, to two and a-half miles per hour; if little difficulty was experienced in the main body of this canal, there could be none from a current of a mile per hour in a canal of double the sectional area. In evidence, the people, navigating the canal, generally condemned the current as very injurious to navigation, but when analyzed it was always in conjunction with some other disturbing cause. The following quotations from the evidence will substantiate this statement:—"There is danger of collision when vessels meet at bridges, or narrow places; it would not be so dangerous if they met in the main body of the canal. We do not find much difficulty in the main body of the canal, except when vessels take a sheer against us. Cote St. Paul lock is the place we dread most, where there is a bar in the canal, where two currents meet. I remember once, we met with an accident to the wheel, in the main body of the canal. I remember no other accident just now in the main body."

"It is especially difficult when vessels meet each other, as each vessel has to sheer over to the side of the canal, when, in consequence of *the level being lowered*, they are apt to run aground."

There were many complaints of vessels grounding on account of the current, when it would swing them broadside to it, the water would bank up behind them and stop navigation, until the reach was raised, and the vessel hauled off. If the levels had been maintained at navigation height there would not have been so many complaints against the current.

The St. Lawrence River is a part of the canal system; the currents, that are met with in that river by propellers, and tugs with tows of barges, from which little difficulty is experienced, should be compared with the proposed current in this canal, which in some countries would be a considerable river. At the narrow channel called the "Fiddler's Elbow" some 1,200 feet in length, and 150 feet, to 528 feet, wide, the current is over two miles per hour; at many parts, between rapids, and canals, the currents is over this.

The mean velocity, which will be determined subsequently, for this canal, is 1.5 per second. We will compare this velocity with others given by authorities in this branch of hydraulics.

In a paper read by M. DeLesseps, before the French Academy of Science, of six years experience upon the Suez Canal, between 1872 and 1878, he states with regard to velocities caused by the rise and fall of tides:—"Between Suez and the Bitter Lakes it varies between 2 feet per second and $4\frac{1}{2}$ feet per second. These currents do not at all interfere with navigation."

The velocity of ordinary rivers is $2\frac{1}{4}$ feet per second.

Limits of velocity usual of canals, is 1 to 4 feet per second.

The maximum velocity that will prevent the deposit of silt and the growth of aquatic plants, is about $1\frac{1}{2}$ feet per second.

Our assumed velocity, would give a gradient of about 1 in 94,000. The limits of tidal navigation for large canals, is, from 1 in 6,000 to 1 in 16,000."—(Hydraulic Manual of Statistics).

It is evident the current, adopted, is moderate in a canal whose mean width exceeds, by 60 feet, the combined width of beam of two of the largest vessels that could navigate it.

The sectional water area, at the piers, and abutments of bridges, is larger than the main body of the canal. Openings, 46 feet wide, and separated by piers, and cribwork, some 20 feet wide, have been made for the ascending, and descending traffic. Vessels would keep their respective sides of the canal, until the Montreal Terminus, is reached, where the large number of basins, and increased body of water, would so deaden any current, that it would not interfere with vessels moving from one basin to the other. We may, therefore, conclude, that, a greater current, which was not

prejudicial to navigation, when the levels were kept up, in a canal of 1,000 square feet sectional area, a less would be no injury in a canal nearly double the area or 1,950 square feet.

One of the complaints, made by owners of barges, upon the old Lachine Canal, was, that it required more horses to tow the same load upon that canal than it did upon the other St. Lawrence canals. It has been found, that the best work of a good draught horse, working eight hours per day, is an average pull of 120 lbs., and with a speed of $2\frac{1}{2}$ miles per hour, in water without any current. If we take, as example, a barge of 450 tons displacement, and of such a form, that four horses will tow it, at this rate, in still water. The effect of a current of one mile per hour, will be that the horses, exerting the same work as in dead water, would come down the canal in 3.2 miles per hour with that number of tons, and will tow up against the current at the rate of 1.86 miles per hour.

Last year upon the St. Lawrence canals the ascending tonnage was little over one-fourth of the descending; if the great bulk of the western grain is diverted to this route, this proportion will be exceeded. The effect of the current will be, under these conditions, no detriment; taking the speed of towing, both up and down the canal, at $2\frac{1}{2}$ miles per hour, the downward tonnage can be increased to the amount that would diminish the speed from 3.2 to $2\frac{1}{2}$ miles per hour, and the less ascending tonnage would more than equalize the difference between 1.86 and $2\frac{1}{2}$ miles per hour. As a principle, the current is no disadvantage so long as the ascending tonnage, is sufficiently less than the descending, to compensate for the retarding influence of the current. It would not have been considered necessary to refer to horse-towing, if not brought forward in this evidence. The era of towing by horses, will be over, when the St. Lawrence Canals are enlarged and the large class of vessels, and barges, adapted to their dimensions, navigate them.

If a canal, in its construction, has not had a declivity given to the bottom, to produce motion, the declivity must be given to the surface of the water, or the lower end of the canal must have a less depth of water than the upper. The injurious effect upon navigation of this means of creating a velocity, is exemplified by the evidence with regard to the old Lachine Canal and the present Cornwall Canal. The levels, furnished me by the Engineers' Office at Montreal, show only one inch difference of level between the new Guard Lock mitre sill and the top of the breast wall of Cote St. Paul Lock, if this canal is ever deepened for vessels drawing 14 feet, it is evident, to supply the mills now in operation, would require either the water to be raised at the Guard Lock above canal level, or the breast wall lowered.

Although this element does not at present enter into the question, as there are two feet upon the breast wall and one foot in the reach to go upon, any design must look forward to the eventual deepening of the Canal to 14 feet.

Recent experiments, upon velocities in canals and rivers, have proved that the formulæ, or coefficients, in general use, are erroneous, especially when applied to rivers, and canals, of large sectional area, and a low hydraulic gradient, to which class this canal belongs. The most accurate method would be to determine by experiment a formulæ suited to the canal, or the value of the coefficient C in the formulæ of M. Chezy,--

$$V=C\sqrt{RS}.$$

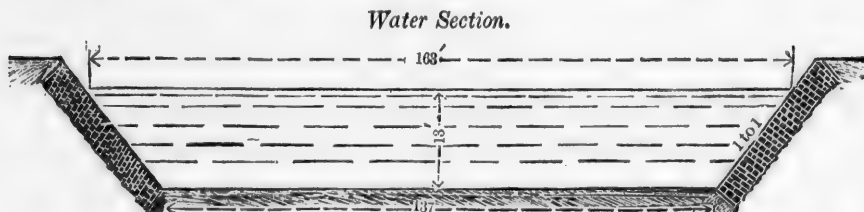
The selection of a proper formula, or coefficient, is important, when it is stated the erosion of the bed, and the destruction of the works of the Ganges Canal, India, was the result of the use of, and reliance upon, the velocity-formula of Dubuat, by the Royal Engineers.

For these calculations the formula of Kutter is used, adapted by Jackson to English feet, this formula is adopted by the Government of India and generally used upon the Continent. It is founded, upon the experiments of Darcy and Bazin and the formulæ deduced, also upon the elaborate investigation upon the hydraulics of the

Mississippi River, and the formulæ deduced by the United States Engineers Humphreys and Abbott, together with numerous investigations, and experiments, by the author himself.

The reach, or level, between the Guard Lock, and Cote St. Paul, is some 23,500 feet in length, the gradient taken is 3 inches in that distance, or 1 in 94,000. That is, the canal level would require to be raised 3 inches at the Guard Lock, or lowered that amount at Cote St. Paul, to give the proposed velocity and discharge.

The form, and dimensions, of the water section for this calculation are as represented in diagram. Other dimensions are under the head notation.



Notation.

Q = Cubic feet discharged per second	2,988:300
V = Mean velocity of discharge in feet per second.	1.532
R = Area of water section in square feet.....	1 950:000
P = Sectional perimeter.....	173:768
$\frac{A}{P}$	
R = Hydraulic Radius —.....	11:221
L = A longitudinal length of Canal.....	23,500:000
H = Fall in that length.....	.250
$\frac{H}{L}$	
S = Sine of the hydraulic gradient —.....	0.0000106383
$\frac{L}{N}$	
N = Coefficient of roughness, &c., (from experiments.)	0.020

Formula (Kutter.)

$$Q = \left\{ \frac{\frac{1.811}{N} + 41.6 + \frac{0.00281}{S}}{1 + \left(41.6 + \frac{0.00281}{S} \right) \frac{N}{\sqrt{R}}} \right\} A \sqrt{RS}.$$

From the above, we have a discharge of 2,988 cubic feet per second, and a mean velocity of say $1\frac{1}{2}$ feet per second. By the ordinary formula ($Q = A 100 \sqrt{RS}$), it would require a fall of nearly 6 inches, which is certainly inapplicable, we may therefore conclude, whatever may be the actual fall, to obtain this discharge, it will not be any injury to navigation.

It has now to be established, whether the orifices, or apertures, for supplying the canal at the head, will admit this quantity of water.

Before entering upon this part of the subject, the method, which is necessary to give precision, and definition, under a new system of leasing will be stated.

In the calculation, of power Lessees will have to pay for, and the supply at the head, we require something more defined,

Capacity of apertures,
for supply, to discharge
into canal this quan-
tity.

than, that at Basin No. 2, the head, or fall, varies from 11, to 25 feet, and at the Guard Lock from nothing, to 4 feet. A standard head must be fixed, which can only be done by taking the average depths of water over a number of years. The levels, of the water in the River St. Lawrence upon the mitre sills of the upper and lower locks of the canal, have been taken, daily, for over thirty years. For the protection of navigation, the season of navigation need only be considered, but as the two interests have been combined, it must be determined, what water, or power, can be furnished the mills in winter.

I have divided the year into two seasons, one called the season of navigation, and the other the winter season. The canal is not generally navigable as long as assumed, the year has been divided, more on the principle, to give the least head in summer and winter, or a fair division of the year, when the head is fixed, for calculating the power Lessees will be required to pay for.

The season of navigation is 244 days, extending from the 17th April to the 16th December, inclusive. The winter season is 121 days, except at leap year, extending from the 17th December to the 16th April, inclusive.

The average level of water for each season has been taken, also the average for 29 years.

It is proposed, the latter average, be the basis of all calculations, for the next period of leasing, that it will be inserted in the conditions, and regulations, which Lessees will have to acquiesce in. It would be stated in this manner,—the Government have established as a basis for all calculations, with regard to water-power upon the Lachine Canal, for the length of time the leases are to be executed; that the level, of the River St. Lawrence, at Lock No. 1, is 20 feet over the mitre sill, and the head, and fall, between Basin No. 2 and the river, is 22½ feet for the season of navigation; that the level of the river for the winter season, is 28 feet 8 inches, and the head, and fall, 13 feet 9 inches. At the guard Lock, the average level of the river, for the same length of time, is 11 feet 8 inches, and the head or fall 2 feet 8 inches for the summer; and the level of river 10 feet 9 inches, and the head 1 foot 9 inches, in winter.

Without there is some great climatic change, or convulsion of nature, this average will hold good, until the expiration of the term of lease; if any changes will have occurred in the meantime, in the characteristics of the river, they may be taken into account upon the renewal. Lessees will lease the power, subject to all diminution of power, or supply, below this average for any day, or season, whether occasioned by fluctuations in the river or the exigencies of navigation. There is appended, a table of the average levels of the river at the head, and foot, of canal, during each season, from 1852, to 1882, from which the standard heads are taken.

Returning to the supply of water at the head of canal;—the water is admitted by two weirs, with 24 sluiceways with a combined area of 504 square feet. Their breast walls are a few inches below the level of canal, and have an overfall of 136 feet, which can be used when the river is low enough to remove the stop-logs. During the winter season, the locks not being in use, the sluices, in the lock gates, may be used, giving an additional area of 121, or in all 625 square feet.

It would be difficult, without experiment, to determine the percentage, of the theoretical discharge, these orifices would supply. I have assumed 62 per cent. and the formula would be,—

$$Q=0.62 A \sqrt{2gh}.$$

During the season of navigation, it would require a head of about 1 foot 5 inches, to discharge into the canal 2,988 cubic feet per second. From the table of average heads, it will be seen, that the standard head is 2 feet 8 inches, and that, in only one season, does it fall below 1 foot 5 inches, viz., 1 foot 4 inches for the season of 1872. It is evident, from these statistics, there will be no difficulty in obtaining, an average supply, of 2,988 cubic feet per second, during navigation. The lowest month of 1872 the head was only 6 inches, which would give a discharge of some 1,902 cubic

feet, or 1,082 cubic feet short, which could be admitted by opening the lock gates a safe distance. As a head of one foot would give about the discharge required, when it fell below this, for any short period, the additional area of supply could be obtained in the manner stated.

During the winter season, as no water would be needed for navigation, only the quantity proposed to be leased for water-powers, 2,400 cubic feet per second, increased to 3,600 feet to compensate for loss of power, through back-water at Basin No. 2, would be required.

As before stated, the area of orifices, for winter supply, is 625 square feet; to give this 3,600 cubic feet would require a head of 1 foot 6 inches nearly; by the table we find the average head 1 foot 9 inches.

Two seasons the river and canal, were upon the same level, five seasons the heads varied from 6 inches to 11 inches. To give the summer supply (2,400), a head, of some 9 inches, would be necessary when it fell below 1 foot 6 inches, the winter supply would gradually diminish to summer supply, and that could always be maintained, by drawing down the reach, between Cote St. Paul and the Guard Lock, to give a difference of level, between it and the river, of 9 inches, or by opening the lock gates to increase the area of supply. By this method, the mills at Cote St. Paul would lose power, but it would be more advantageous, than, that the power should be lost at Basin No. 2 and St. Gabriel.

It has now been shown, as far as statistics could prove, that theoretically there is no danger of a repetition of what took place, upon the old canal, at the time the water-powers were leased. If the apertures, in practice, are not sufficient to admit this quantity of water, additional works could be constructed for that purpose, as the income would justify the expenditure.

It is necessary to determine what proportion, of this 2,988 cubic feet, flowing through the canal during the season of navigation, it would be judicious to lease for water-power. The demands for water, upon a canal, are two, first—the loss from filtration, evaporation, leakage through the lock-gates, &c., second—the loss from lockages. For the first, any calculations must be approximate, and dependent upon many conditions. Rankin gives for, “waste of water by leakage of channel, repairs and evaporation, per day—area of surface of canal multiplied by $\frac{1}{8}$ of a foot nearly,” upon this canal it would amount to about 15 cubic feet per second. For this waste, observations, have been made, upon various American canals, of small sectional area. I have taken an average of several, and allowed for the difference in sectional area, although the evaporation would not be relatively so great upon this canal, on account of the climate not being so hot, and the water would not become so heated, as in a small, and shallow canal; it would give 51 cubic feet per second. Obtaining the leakage, through lock gates, in the same manner, it would give for this canal 30 cubic feet per second. Rankin states, that this waste is from 10,000 to 20,000 cubic feet per day, which of course, depends upon the size of lock and lift.

J. B. Jarvis, C.E., estimated the loss upon the old Erie Canal to be 100 cubic feet per minute per mile; for a canal of this area, it would be some $21\frac{1}{2}$ cubic feet per second per mile, or for the whole canal 182 cubic feet per second. For this loss then, according to, Rankin, it would not be over 20 feet per second, observations upon a number of canals 81 cubic feet, and Jarvis 182 cubic feet. In making an allowance for the Lachine Canal, there are two sets of locks to be taken in account; with the exception of evaporation, and filtration, this loss, through lock gates, and weirs, depends upon the state of repair the canal is kept in; 200 cubic feet per second is a very large allowance.

Water used in lockages.—An elaborate calculation might be made of this expenditure of water; the number of tons used by vessels, according to their displacement, in passing from one level to the other, for this discussion this refinement is unnecessary. There are two systems of locks; the traffic will probably never be sufficient to occupy both; we will assume it will be. Allow 15 minutes for a lockage, and a

Quantity of water judicious to lease, for hydraulic purposes.

lock-full of water is wasted each lockage, without reference to the volume displaced by the vessel, it would require for the highest lift upon this canal some 306 cubic feet per second in addition to the 200 cubic feet allowed for leakage, &c. It is now evident, that in the proposition to lease 2,400 cubic feet for water-powers, ample allowance has been made, 588 cubic feet per second, to prevent any injury to navigation, from excessive draught of water by the mills.

The method of measuring water supplied to the mills has been explained. Weir measurement is the simplest where applicable, it could not be applied at Cote St. Paul or St. Gabriel as the head and fall is so small that the power lost by diminishing the head, would not be compensated by its advantage; nor is the same protection required for navigation at these places, on account of the water being returned into the canal. At Basin No. 2 as the water is discharged into the river, for the measurement of water and protection of navigation, weirs would be advantageous; the mills upon the Henares Canal, in Spain, are supplied with water over weirs.

It has been stated previously that Mr. Barrett in designing these water-powers had that intention. The reduction of head, by the use of weirs, depends upon the quantity of water leased by each mill. In the season of navigation the standard head would be reduced to about 20 feet. During the winter the water would be supplied through sluices or openings under water; the head and fall is 13 feet 9 inches, making an allowance of 9 inches, for fall between head-race and canal, we would have for the computation of power, upon this basin, in winter a head of 13 feet, and in summer a head of 20 feet.

It is proposed to lease the water by horse-powers, each horse-power to be defined, by a specified volume of water, at the different falls, and to be 75 per cent. of the theoretical power of the water. The quantity of water is expressed in one figure for simplicity. At Basin No. 2 it would be 0.6 cubic feet per second per horse-power in summer, and 0.9 in winter.

The leases would read: "The said Lessee shall have the right, and privilege, of taking, and using, from, and out of the canal of the Lessor, 200 horse-powers of water, each horse-power to be drawn under, and by virtue of this lease, shall consist of 0.6 cubic feet per second, and no more, over the weir in summer; and in winter shall consist of and be 0.9 cubic feet per second, and no more, through the sluices.

At Basin No. 2 there would be an available power of 4,000 horses. The only position in which it can be utilized, is now leased, the majority of the lots as mill privileges; five of them have no water apportioned; the Government have been receiving, only a revenue, from the rent of the land, for these, instead of the increased value from the conjunction of land, and water-power.

It is evident it would be a loss to the community to permit the occupation of these mill-sites for any other purpose than they were originally intended. The power would thus be divided into twenty mill-sites or privileges, with power equal to 200 horses attached to each.

If any of the present occupants required more power, or less than this, it might be apportioned, but the principle remains that this position should be devoted to the utilizing of the water-power upon this basin.

Elsewhere, the value of power, similar to what is furnished upon the Canadian canals, is stated to be \$10.50 per horse-power per annum; \$5.00 per annum was the price charged thirty years ago by the Government; its cost in the Eastern States has been given, and a comparison with the cost of steam-power. Situation and circumstances, the price of coal, and the demand for power for manufacturing purposes govern its value, as will be seen from prices quoted from a work by Moncrieff dated 1868:—

Measurement of water.

Water to be leased by horse-powers with a specific volume.

Power available at Basin No. 2.

Value of power.

Eastern Jumna Canal, India, H. P. per annum.....	\$230.00
Isabella II. Canal, near Madrid, Spain do	119.00
Marseilles Canal, France do	42.00

With which we may compare—

Average price several companies, United States, H.P., per annum.....	17.50
Beauharnois Canal, Canada, H. P., per annum.....	1.00

On the Marseilles Canal "the tenant is obliged to make all his own arrangements for a mill-lead, mill, &c., and must give back all the water into the canal again. The town stipulate that they may close the canal for two periods, of fifteen days each, for silt clearance, repairs, &c., without paying any indemnity. Further, that customers must submit to a reduced supply should the canal discharge be necessarily lowered, or, should it be obliged to be closed altogether on account of some accident, provided, this reduced supply or closure does not last more than thirty days; if it does, the customers are entitled to a proportional reduction of their rate."

It is obvious that Lessees upon the Lachine Canal will not have to submit to restrictions which would render their power less valuable than these would.

Power in the heart of the City of Montreal is worth more than, say, upon the Williamsburgh Canals; as a fair price, I have taken \$12.00 per horse-power per annum. At Lewiston, Maine, where there is no water communication, and distant from the great business cities of the Eastern States, its cost is \$12.50 per horse-power.

The opinion, of a valuator, has been obtained, which is appended, of the present

Value of land occupied by hydraulic lessees and annual revenue to be derived from water-powers.

value of the Government land, occupied by the mills upon this canal, apart from any increased value, it may have by its proximity to water-power, or what it would sell for, at auction for other purposes.

Directly behind the mill-sites, upon Basin No. 2, the Montreal Harbour Commissioners are building a wharf, along which I understand a railway track is to be laid, and placed in communication with the railway system. Both in front and rear, it is so situated, that these mill-sites will become very valuable in the future.

These lots when leased had each 80 feet frontage and extended to the edge of the River, with a street, (Mill Street), reserved. Between this street and the basin the mills are situated, making a strip of 140 feet wide, and 1520 feet long, (all measurements are scaled off plans.) On the river front a division line has been settled upon, and a notarial agreement executed, by the Lessees and Harbour Commissioners; upon this line the wharf is being built. Streets running at right angles between the river and Mill street were also agreed upon. Some parts of this land lying between Mill street and the Wharf are worth 25c. per square foot, others more. It is obvious that when the leases are renewed, if this property is again leased with the mill sites, the future value should be taken into consideration, to any increase of which, these Lessees would have contributed little.

The position, of Tate's Dry dock, according to the plans of the present enlargement, is to be occupied by a basin, it is probable that this lease, if the trade of Montreal would require this basin, would not be renewed, for any long period, it has, therefore, not been taken into consideration.

Three mill lots 80 feet by 140 feet, could be laid off near this basin, where the present mills are situated, which would make 22 lots between which this power could be divided.

The annual revenue, which should be derived from the water powers upon this canal, is as follows:—

Basin No. 2.

22 lots—80 x 140=246,400 sq. ft. at 80c.=	\$197,120 at
6 per cent.....	\$11,827.20
Between Mill Street, & Harbour Commissioners Wharf, exclusive of streets, 310,000 sq. ft. at 25c.=	\$77,500
at 6 per cent.....	4,650.00
Water power, 4,000 horse-powers at \$12.00.....	48,000.00

Total yearly revenue from Basin No. 2..... \$64,477.20

St. Gabriel Lock.

The head at this lock is 8.66 feet; the head taken for the calculation of power is $8\frac{1}{2}$ feet, which with the stated percentage, the theoretical power bears to effective, would give 1.4 cubic feet, of water, per second, to each horse-power. The full power of this lock would be 1714 horse-powers, from the plan there appears to be some 71,200 sq. feet occupied by sub-lessees of Young and Gould.

71,200 sq. feet at \$1=	\$71,200 at 6 per cent.....	\$ 4,270.00
Water-power, 1,714 horse-powers at \$12.....		20,568.00

Total yearly revenue from St. Gabriel..... \$24,838.00

Cote St. Paul Lock.

The head at this lock is 9 feet. It has been shown previously, that during the winter season, in years of low water, it might be necessary to draw down the upper level, to afford a head, between it and the river; it is proposed to reduce the head 6 inches on this account, in the calculation of power, in which case the same power would be obtained as at St. Gabriel's, and the same quantity of water, 1.4 cubic feet per second to each horse-power.

There is some 130,000 square feet occupied in connection with the mills.		
130,000 sq. feet at 15 cents=	\$19,500 at 6 per cent.....	\$ 1,170.00
Water-power, 1,714 horse-powers at \$12.00.....		20,568.00

Total yearly revenue from Cote St. Paul..... \$21,738.00

The following comparison, will show the difference, between the present annual revenue, and the revenue to be derived from a fair value:—

Basin No. 2, rent proposed,	\$64,477.20, rent received..	\$9,030.00
St. Gabriel, do	24,838.00, do	1,680.00
Cote St. Paul do	21,738.00, do	1,601.00
Total,	\$111,053.20	\$12,311.00

By this proposed change there would be an increased annual revenue of \$98,742. For the fiscal year ending June, 1881, the amount expended on this canal for repairs and maintenance was \$58,910; if the Government received what they were entitled to under the present leases, it would nearly balance the expenditure.

There is upon this canal in round numbers 10,000 theoretical horse-powers, and as large a water-power as some of the most important in the

Comparison of Water-Powers.

Lachine Canal.....	horse-powers	10,000
Lowell, Mass.....	do	10,000
Lawrence, Mass.....	do	10,000
Lewiston, Maine.....	do	7,500

The Ousatonie Water-Power Co., have 2,500 horse powers of permanent water, the surplus or variable water gives a larger power than this, to obtain which a dam containing 451,000 cubic feet of masonry was constructed, 870 feet long and 22½ feet high with an apron of timber and concrete. The canal has a sectional area of 840 square feet, and is 3,700 feet long. The charge for surplus water which gives no more steady power than upon this canal is \$16.00 and \$26.50 per horse-power per annum for permanent water.

It is obvious, from the evidence adduced, that the Government would be justified in cancelling the present leases of water-powers upon this canal and inaugurating upon the enlarged canal, a new system upon scientific and business principles. There would be complaints of this, of what they would term, arbitrary action of the Government, to prevent which I should recommend, that before taking action upon the leases, the Government order the sluices, that at present supply the mills on Basin No. 2 to be closed and locked during the summer, that the stop logs be removed, which will enable the water that is leased and paid for to flow over the breastwall. That at St. Gabriel and Cote St Paul, all the water be closed from the mills with the exception of 20 runs of stones, which has been previously proved to have been all the surplus water at the date of the lease. After a short experience of their own, and the Government's rights, they would gladly enter into new arrangements, for the term of years for which the leases are renewed.

Cancelling the present leases.

If these leases had been perpetual, or were to be renewed on the same terms, it is open to deal with the Lessees in the same manner that the surplus water is managed by the Water-Power Companies, in the Eastern States. For the water used above what is leased, new leases could be drawn up and a sufficient price charged for it, to bring the total rents up to the present value. At which action there could be no complaint; the Lessees would obtain what they leased, and beyond this the Government have a perfect right to administer the additional water-power created by the enlargement in whatever manner they may deem fit.

At St. Gabriel, and Cote St. Paul, additional land, to what was leased from the Government, was bought to utilize the water-power. Two methods could be applied to these places, first, the land belonging to the Government occupied by sub-lessees might be leased to them individually. The land belonging to the Lessees sub-leased, is no concern of the Government, as they bought only five mill lots and twenty runs of stones, which required no additional land to utilize, therefore it is only a matter which concerns themselves. The water in this case would be leased at the bank of canal; if several sub-lessees draw water from the same raceway, it would be left to themselves to apportion the water each was entitled to; they becoming jointly responsible for the rent of the water, which enters the raceway at its junction with the canal. The water, in excess of what is now sub leased, could, in the event of the mills now in operation not requiring more power, be leased to other parties after the necessary land had been acquired.

Second.—The Government could expropriate all the land upon which the present mills are situated, and sufficient additional land to utilize the full power, and lease both land and power.

I have concluded a preliminary sketch of a scheme which could be more fully elaborated if any action be taken.

Any design which combines the two features, of water-power and navigation, would be an utter failure if the same course is pursued upon the enlarged canal, as upon the old, and in any event without practical and intelligent management.

The canal is large and the supply of water is adequate. Mill owners can draw additional water without interfering with navigation.

If the community is willing to submit to loss of revenue, and present the Lessees of hydraulic lots with cheap power, no change is required, and no positive injury will be done except in the waste of power, and the retarding influence upon the advancement of the country in practical hydraulics.

As an exemplification of no management, and some management, of the Govern-

ment as Lessors, and private individuals as Lessors, Basin No. 2 and St. Gabriel may be compared.

At Basin No. 2 they were allowed to draw what water they wished, during the season of navigation. Power, and water, required for navigation, were wasted through loss of head, it being immaterial in what position water wheels were placed, in what manner, or of what class, so long as they obtained water sufficient to drive their machinery. There has been little improvement in the last thirty years.

At St. Gabriel the sub-lessees were required to pay for the water used, as those leasing the power looked after their own interests. Continual changes, and improvements, have been made at this place, and there is generally a better class of machinery, than upon Basin No. 2.

In this investigation I had occasion to examine the systems adopted in France, Italy, Spain and India, upon the extensive canals in those countries. The manner in which private Water-Power Companies in the Eastern States manage their water-power is stated elsewhere. The administration of these matters in Canada, compares unfavorably with other countries.

I have concluded a history of the water-powers upon the old Lachine Canal, and a scheme proposed to be adopted upon the enlarged canal.

I have endeavored to obtain by personal research, all evidence afforded by the records of the Department, and Registry Offices in Montreal, with regard to the present leases.

From the imperfect manner in which the books of the Board of Works were kept, thirty years ago, and documents arranged, and filed, important information may not have been found, and links of evidence omitted, but the conclusions arrived at, are such as, what has been adduced appeared to warrant.

By the renewal clause, at the expiration of the term of lease, the Government have bound themselves, to renew for another term of twenty-one years, that period was passed some years ago. If the Lessees at the expiration of their term of lease, did not demand its renewal, their occupancy might perhaps, at present, be considered a yearly tenure, instead of a twenty-one year's tenure, and the Government in the position to commence *de novo* upon the enlarged canal; a different canal with changed conditions.

Whatever rights Lessees may have had upon the old Lachine Canal, it has to be determined how far they are binding upon the present canal. It has been attempted to prove what these rights are, or what the Lessees are legally and justly entitled to.

I have the honor to be, Sir,
your obedient servant,

ROBERT C. DOUGLAS,
Assistant Engineer Railways and Canals.

LIST OF APPENDICES.

APPENDIX A.

- No. 1.—Copy of report of Mr. Barrett, upon which the Governor in Council, sanctioned the sale by Public Competition, of the first hydraulic lots sold at Basin No. 2.
- No. 2.—Copy of letter of the Secretary of Public Works, transmitting said Report.
- No. 3.—Copy of Order in Council approving of sale.

APPENDIX B.

- No. 1.—Copy of conditions, regulations, etc., of Mr. Barrett, read at public sale.
- No. 2.—Copy of certificates of Auctioneers, that these conditions, and regulations, were read at sale, and the parties to whom the lots were adjudged.

- No. 3.—Copy of letter of Secretary Public Works transmitting these conditions, and leases for the approval, and sanction of His Excellency in Council.
 No. 4.—Copy of the Order in Council approving of the leases.
 No. 5.—Copy of extracts from lease, which incorporates the conditions and regulations of Mr. Barrett with it; also provides for the payment of any water above the quantity specified.

APPENDIX C.

- No. 1.—Copy of that portion of Chief Engineer's Report of 15th January, 1851, laying off the land and water-power at St. Gabriel in lots and as advertised for sale.
 No. 2.—Copy of application for the control of the land and water by John Young, Esq.
 No. 3.—Copy of Statement of Mr. Cantin, of the manner in which the St. Gabriel property was put up and sold at Public Auction.
 No. 4.—Copy of Report of Chief Engineer upon Mr. Young's application.
 No. 5.—Copy of a part of the Chief Engineer's Report, which is attached to Report of January 15th, 1851, approving of the lease of all the land and water.
 No. 6.—Extract from a Report, on water-powers, Welland Canal, 28th June 1847, by the Chief Engineer, when Engineer of that Canal, with reference to leasing to Companies exclusive privileges.

APPENDIX D.

Valuation of the Government land now leased to hydraulic Lessees upon the Lachine Canal, at its present value at Public Auction, by T. J. Potter.

APPENDIX E.

Table of wheels, sluices, etc., etc., and approximate capacity of discharge therefrom, at the different hydraulic lots.

- No. 1.—At Basin No. 2.
 No. 2.—At St. Gabriel.
 No. 3.—At Cote St. Paul.

APPENDIX F.

Table of average levels of water, during the season of navigation, and the winter season of the River St. Lawrence at Lock No. 1 and Guard Lock, also of the head and fall between river and canal at those places.

APPENDIX A.

No. 1.

COPY of Report of Mr. Barrett, upon which the Governor in Council, sanctioned the sale of Public Competition, of the first hydraulic lots sold at Basin No. 2.

MONTREAL, April 11th, 1844.

DEAR SIR,—I herewith enclose you a copy of the land belonging to the Board of Works in Montreal, shewing some points for the location of mills, warehouses, ship-yards, &c. At Locks No. 4 and 5 there are good locations for mills which may be connected with extensive warehouses. Grain and freight can be conveyed to them by a rail track from the Basins above them laid parallel to the line of Basin; these mills will have each 13 feet fall; if there is an objection to discharging water from a mill at No. 4, this mill may be omitted, placing one at Lock 5.

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At the south side of the old Locks there is a good location for a flouring establishment where the whole fall is at command (26 feet). This may be located close to the side of the old Lock, by providing for the working of one wing of the Lock Gate, without the use of the balance beam. The ground adjoining the Collector's house may be brought into valuable use. At the point near the Emigrants Hospital there is a good location for mills, commanding the entire head. Each run of stone at this place will not require more than 400 cubic feet of water per minute. A mill may be placed here for cutting ship plank.

I have marked out ground for an extensive shipyard next to and above the graving docks. The turn in the canal below this point and the great width and depth of the canal renders it convenient for launching vessels. I have taken the opinion of ship-builders who think it well adapted for this use. I have laid down a canal 60 feet wide leading to the mill sites at the Hospital, which passes the shipyard, and will add to the convenience for receiving timber.

I have marked down the sites for a number of warehouses, at the different locations. Along Wellington Street there may be a number of buildings placed, the lofts of which may be connected with the warehouses upon the basin with shops below. Or the ground may be left free and open from the street to the warehouses.

The subdivisions of the ground will require a careful revision, but the enclosed will serve as a commencement. We will not be prepared to let the water into the canal before the 15th or 16th. The ice has continued so fast in the canal, that some indispensable repairs could not be made. The forwarders are crying out against the early opening of the canal, as they are repairing their boats in it. They will however press their repairs under the supposition that the water will be let in as early as the 15th, and will be out of the way.

On relation to the water-power created at Montreal by the canal, I am of opinion that there will be 15,000 cubic feet per minute available without producing a current of more than half a mile per hour including the supply for the lockages.

I have the honor to be,

Your obedient servant,

ALFRED BARRETT.

No. 2.

Copy of letter of the Secretary of Public Works, transmitting said Report.

PUBLIC WORKS,

MONTREAL, 12th October, 1846.

SIR,—I have the honor to lay before His Excellency the Governor in Council, by direction of the Commissioners, Mr. Barrett's report on the available water-power at the Montreal terminus of the Lachine Canal.

The report was ordered in consequence of a very urgent application having been made by Mr. Merritt and others, for the purpose of erecting a flouring mill at Lock No. 2. The site is a very valuable one, and should, in the opinion of the Commissioners, be offered to public competition at the same time with the other two marked out on the Upper Basin—say on the 15th November next.

Mr. Merritt states that he would have an extensive establishment in operation early in the spring if he could obtain the site at once, but I am desired to state that in the judgment of the Commissioners, as the one he desires to obtain is the most valuable, it should be put up at auction. He is anxious that no time should be lost, as he thinks it important to have his mill in operation, so as to avail himself of the remaining two years of protection for flour in the British market. The Commis-

sioners therefore respectfully request that the decision of His Excellency in Council may be communicated to them as early as possible.

I have the honor to be, Sir,
Your obedient servant,

THOMAS A. BEGLY,
Secretary.

No. 3.

COPY of a Report of a Committee of the Honorable the Executive Council dated 16th October, 1846, approved by His Excellency the Governor General in Council, on the same day.

On a communication from the Secretary of Public Works, dated 12th instant, transmitting the report of Mr. Alfred Barrett, Engineer, on the subject of three sites for mills and warehouses at the Montreal terminus of the Lachine Canal, and which in the opinion of the Commissioners should be offered to public competition :

The Committee humbly advise Your Excellency to sanction the sale of the three mill sites in question, upon terms to be submitted for approval by the Commissioners of Public Works.

Certified, E. PARENT.

To the Provincial Secretary.

APPENDIX B.

No. 1.

COPY of conditions, regulations, etc., of Mr. Barrett, read at public sale.

DESCRIPTION of the hydraulic privileges upon the Lachine Canal, now offered for lease by the Department of Public Works.

The lots now offered to be leased are Nos. 9, 10 and 11, situated upon the south side of the canal basin (No. 2), opposite the forwarding warehouses.

They will have each 80 feet of frontage upon the canal basin, from which they will be supplied with sufficient water, calculated to drive four runs of stones by overshot wheels, or enough to propel other machinery requiring an equal amount of power. The lots will extend from a line parallel to 8 feet distant from the face of the coping of the wharf or dockwalls at top, to the river, leaving a road reserve of 40 feet in breadth at a distance of 150 feet from the front of the basin wall. Loaded vessels may come alongside the wharf for discharging and receiving freight; and buildings may be erected fronting upon the basin, provided their front walls are not built within 10 feet of the face of the basin walls.

The fall at lowest water in the river opposite these sites, will be about 26 feet, and at the ordinary summer level in the Montreal harbour about 24 feet. During the season of navigation, the water will be supplied over a waste weir of suitable breadth, the upper edge of which will be six and a-half inches under top water line of the canal, to supply about 360 cubic feet per minute for each run of stones, excepting at such periods when irregularities, in the level of the basin, necessarily arising from a rapid succession of lockages from or into it, may for a time increase or diminish the supply.

In winter the water will be supplied, by sluices, through the walls, the top of which will be placed four feet below the surface of the water in the basin.

Flumes will be constructed behind the wall to receive the water and conduct it to the wheels, they will be placed one half their breadth on each lot, and carried as far as 30 feet from the face of the wall at the expense of the Department, with a partition formed to separate the water opposite to each lot if necessary, but the remainder must be built by the lessee of each lot, and at his own expense, who will also be required to keep the whole of it in thorough repair. The mill race must be conducted under the road, which is to be formed to such grade as shall be established by the Department of Public Works, after the race has been completed.

There will be 2 sluices affording a supply for each run of stone of about 360 cubic feet per minute (the same as supplied over the weir) for each lot, the machinery for which will be provided, placed, governed, and regulated by the Department, and will be always under its control.

For the effective working of the machinery, it will be necessary, while it is running to have a fall of about 12 inches from the surface of that in the Race immediately over the wheel, and allowing the same fall in the Tail Race, the clear head and fall will be reduced to about 22 feet in the ordinary stages of the River during the summer.

Whatever buildings may be constructed by the Lessees, on these lots, shall be substantial erections of brick or stone, roofed with sheet iron or tin, or otherwise rendered fire-proof, and shall be subject, in all particulars, to the laws of the Corporation of Montreal.

The foregoing description, is given for the information of persons desirous of leasing the Lots, but it is to be particularly observed that the Department does not guarantee to the Lessees any more water than will be supplied in summer over the weir and in winter through the sluices.

The water in the Canal to be at all times (summer and winter) kept up to full height, except in case of a breach, or when repairs, alterations, or amendments, are to be made in the Canal or any of the works connected with it, requiring the water to be drawn off for a time. The Lessee is to take the privilege upon the above conditions, and at the risk to himself, of all stoppages, or interruptions, occasioned by the contingencies referred to and including obstructions from frost in the vicinity of the supply.

The water, in the enlarged Canal on this reach, will not be raised to its full height until the 1st August, 1847,—and the Department will not, therefore, guarantee a supply of water until that period.

The Department also reserves the right of supplying this quantity through the sluices, or over the weirs, at any season, at their own discretion. The supply subject in either case to the irregularities before mentioned.

It is also to be understood, that in reserving a breadth of 8 feet from the front of the Lots, parallel to the walls, that it is reserved with a view of allowing the Officers of the Government, a free passage for making, repairs, or inspection, of the sluices, and races, or for working the sluice-gates or for any other necessary purpose connected therewith.

ALFRED BARRETT,
Engineer.

No. 2.

Copy of Certificates of Auctioneers, that the conditions, and regulations, were read at sale, and the parties to whom the lots were adjudged.

This day, November 23, 1846.—The above conditions were read to the audience called together by public advertisement, and the Leases were adjudged subject to the above conditions as follows:—

Lots No. 11 to McDougall.
do 10 to Thomas Peck.
do 9 to Lovett.
do 8 to James Harvey.

Each for the sum of one hundred and seven pounds ten shillings per annum.

JOHN LEEMING,
Auctioneer.

MONTREAL, 23rd November, 1846.

The privileges will be leased for a term of twenty-one years, the rent payable half-yearly. The Lessee to have the option of obtaining a lease for a second term of twenty-one years, the ground rent for such second term to be settled by Experts, or by Arbitration. At the end of such second term, the property with all the improvements to revert to the Crown. The Crown to have the power of resuming the property at the end of the first term of twenty-one years, upon paying for all buildings, and erections, standing thereon, at the end of the term, at a valuation to be settled by Experts, or by Arbitration. The rent to commence from the date of sale.

All vessels loading or unloading in any of the Canal Basins shall be subject to such canal regulations as may be established from time to time for the regulating of the traffic of the canal and for the convenience of the trade.

JOHN LEEMING,
Auctioneer.

MONTREAL, 12th January, 1847.

The foregoing conditions were read to the audience, and Water Lot No. 12 was adjudged to Thorne & Heward for the annual rent of £108 currency.

NORMAN BETHUME,
Auctioneer to Her Majesty.

22nd May, 1847.

At an auction held this day for the sale, pursuant to public advertisement, of Lot No. 13, the annexed conditions were read over and the following additions, and alterations, were made as conditions upon which the lot was sold.

Page 1.—The lots will extend from a line parallel to, and 10 feet distant from, &c., instead of 8 feet.

Page 3.—The flumes will be carried back 12 feet instead of 30 feet from the face of the wall.

Same page.—The lines scored underneath were omitted, and the following substituted: "There will be one sluice, for each Lot, affording the same supply of water as above stated, and another sluice for each Lot may be put in at the option of the Department."

Page 5.—The water will not be raised to its full height until the 15th September, 1847, instead of 1st August, 1847.

Whereupon the said Lot, No. 13, was adjudged to Messrs. Thorne & Heward, for the annual rent of £108. And upon request of the company present and with the consent of the Commissioners of Public Works, the adjoining Lot No. 14 was then

put up, and adjudged upon the same conditions to Mr. Gould at the annual rent of £108.

JOHN LEEMING,
Auctioneer.

No. 3.

COPY of Letter of Secretary Public Works transmitting these conditions, and leases for the approval and sanction of His Excellency in Council.

PUBLIC WORKS, 3rd July, 1874.

SIR,—I am directed to enclose two leases of water-power, on the Lachine Canal, to Mr. Gould and Messrs. Thorne & Heward, and I request the sanction of His Excellency in Council for perfecting the same in accordance with the Act 9 Vic., chap. 37.

I have the honor to be,
Your very obedient servant,

THOMAS A. BEGLY,
Secretary.

The Hon. D. DALY,
Provincial Secretary.

No. 4.

EXTRACT from a Report of a Committee of the Honorable the Executive Council on Matters of State, dated 15th July, 1847, approved by His Excellency the Governor in Council on the same day.

On the letter of the Commissioners of Public Works, dated 3rd July inst., transmitting two leases of water-power on the Lachine Canal, and requesting the sanction of Your Excellency in Council for perfecting the same in accordance with the Act 9 Vic., chap. 37:

The Honorable the Attorney-General for Lower Canada, to whom these leases have been submitted, states that having perused the leases from the Commissioners of the Public Works to Ira Gould and Messrs. Thorne & Heward, he is of opinion that there exists no objection to Your Excellency's approving of the same.

The Committee therefore humbly advise Your Excellency to approve of the leases accordingly.

Certified, W. H. LEE.

No. 5.

EXTRACTS from lease, referring to conditions read at sale, and the clause binding Lessee to pay for additional water used above the amount specified.

Subject however to the conditions hereinafter mentioned, part whereof were read over, and agreed upon at the time of sale, of the said lot, by public auction on the 22nd day of May, and the remainder have been since agreed upon between the parties hereto, and are substituted as containing the final and express conditions upon which the lease of Lot 14 and the supply of water thereto is granted, and such parts of the conditions of public sale as are repugnant hereto are hereby rescinded, and such other parts as are not hereby rescinded are to remain in force.

That should it hereafter be found that the said sluices will admit a greater volume of water than will be sufficient to propel four runs of mill stones and machinery, by means of the most approved wheels, the said Ira Gould should not be entitled by this lease to receive the whole thereof, but the said Commissioners shall and may regulate and lessen the volume of supply to him, by lowering the sluice gates.

That should the said Ira Gould be desirous of obtaining the whole of the water-power that can be supplied through the said sluices, the said Commissioners, will, upon receiving the sanction of His Excellency in Council, grant it upon determining the amount of additional rent to be paid therefor.

And the said Ira Gould for himself, his executors, administrators and assigns, doth hereby covenant and agree with the said Commissioners, and their successors in office, that he will well and truly pay the said rent in manner aforesaid free from any deduction Nor will he have a claim or right to the whole of the water that could be supplied through the said sluices, in case they should be found more than sufficient to propel more than four runs of stones and machinery. And that the said Commissioners and their officers, may at all seasonable times have access to the said premises that they may consider necessary connected with the management of the said canal, or for the purpose of examining the condition of the said flume, or for ascertaining the amount of water used or supplied through the sluices."

APPENDIX C.

No. 1.

Copy of that portion of Chief Engineer's Report of 15th January, 1851, laying off the land and water-power at St. Gabriel in lots and as advertised for sale.

At St Gabriel Lock.

The head and fall of this lock is eight and a-half feet. Lot No. 22 has a frontage of 165 feet on the canal, width in rear 125 feet, and depth 125 feet, reserving a passage in front of 12 feet in the clear for a towing path. Lots Nos. 23 and 24 have each a frontage on the canal of 132 feet, reserving 12 feet in front for a towing path.

A right reserve for passing water through the common race-way of Lots 22, 23 and 24 for supplying Lots 22 and 23 as well as for any other lots that may hereafter be granted nearer the City.

The parties taking these lots are also to bear equally the expense of constructing the common race-way for supplying the water-power at the head of the old lock.

Lot No. 25 is the Island in connection with the lock containing a little upwards of three arpents in area, and is adapted for the construction of a dry dock.

Lot No. 26 on the south-east side of the canal has also been laid off for a dry dock, for which purpose it may be used by enlarging the swing bridge at the Priest's Basin, or making a floating bridge instead of it and by deepening the basin. The water to be admitted by a pipe laid in connection with the race-way or flume from the head of the lock, which may be used for propelling the machinery and pumps to be established in connection with the proposed docks. This lot is 277 feet in width and 582 feet in length, reserving 12 feet for a towing path above the lock, and a right for passing the water from the tail-race of lots 27 and 28, or any other lots, hereafter to be granted to the westward of them into the basin connected with the canal.

Lot No. 27 in south-west side of the canal has a frontage of 132 feet on the canal, and a depth of 264 feet on the north-east and 257 feet on the south-west side, reserving a passage in front for a towing path of 12 feet in the clear, and a right for passing the water from the tail-race of lot 28, or any other lot in future granted to the westward. Lot No. 28 has a frontage of 132 feet on the canal, and a depth of 257 feet on the north-

east and 250 feet on the south-west side, reserving 12 feet for the towing path, and a passage for the water from the tail-race of any lot that may in future be granted to the westward.

A road 40 feet in width has been laid off in rear for the accommodation of Lots 26, 27 and 28, and connected with the road extending along the canal from Brewster's Bridge to Wellington Bridge.

The parties leasing these lots are to bear equally the expense of opening the tail-race common to all, and each party to construct their own flumes for receiving and discharging the water.

The conditions in regard to the dock Lots Nos. 25 and 26 are the same as those attached to the dock lot No. 21, at Montreal.

No. 2.

COPY of application for the control of the land and water by John Young, Esq.

MONTREAL, 12th December, 1852.

SIR,—I beg to enquire whether the Board of Public Works are willing to lease the whole of the lands and privileges on the Lachine Canal included under the third head of the public advertisement, to an association of individuals, they (the latter) binding themselves to make all the necessary sluices and other works (hereto constructed by the Board of Public Works,) and also to acquire all the necessary lands exterior to those belonging to the canal. The parties with whom I act in this project, are anxious to have the entire control of the water-power of this section of the canal, and should the Board be favorably disposed towards this proposition, they are prepared to make an offer for the entire surplus water of the level above St. Gabriel Lock, so soon as they are informed what conditions and restrictions may be deemed necessary on the part of Government.

I have the honor to be, Sir,
Your obedient servant,

JOHN YOUNG.

THOMAS A. BEGLY, Esq.,
Secretary Board of Public Works.

No. 3.

COPY of Statement of Mr. Cantin, of the manner in which the St. Gabriel property was put up and sold at Public Auction.

MONTREAL, 4th February, 1882.

I was present at the auction sale of water privileges at St. Gabriel Lock, on the 14th February, 1851. The property was offered for sale by the auctioneer, in five mill privileges, with 20 runs of stones attached, and was sold to Messrs. Young & Gould, with the amount of power specified, (or four runs of stones to each privilege) in one block, for four hundred and twenty pounds currency.

(Signed) A. CANTIN.

Witnesses:
C. A. CANTIN.
R. C. DOUGLASS.

No. 4.

COPY of Report of Chief Engineer upon Mr. Young's application.

PUBLIC WORKS, TORONTO,
21st December, 1850.

SIR,—Respecting the application of John Young, Esq., on behalf of a company proposing to lease all the surplus water of the Lachine Canal passing round the lock at St. Gabriel, I have the honor to state—

It appears very desirable for the general interests of the country to encourage the formation of such companies for the establishment of machinery and using the water-power along the line of the canals, and it may even be considered advisable to give a *preference* to the application of companies over those of individuals, wherever, as in this instance, the company can offer satisfactory reference as regards their capital and capabilities of bringing the whole power into full operation.

But, however desirable it may be to encourage companies, and the introduction of capital, it is to be feared the Commissioners cannot in this instance with propriety overlook the claims of previous applicants.

There are now in this office several applications for privileges at this lock, some of them of more than two years' standing, and according to the principle and practice regulating the disposal of such lots, *i.e.*, of setting them up at public auction whenever more than one application is received for the same lot, there appears to be no way left to advertise the whole, or all at St. Gabriel. In this case the Company will have an opportunity of obtaining entire control of all the surplus water at this lock as they seem desirous of doing.

For the conditions attached to the leasing of the water-power, Mr. Young may be referred to the printed ones sent to Mr. Gough at Montreal, who can also inform him as to the upset price placed on each lot. Six mill lots of 20 runs of stones each have been laid off on St. Gabriel, at an upset rental of £100 per annum for each, and a seventh lot, consisting of the island above and adjoining the locks, suitable for a dry dock, with water-power equal to four runs of stones, at an upset price of £150 per annum—making in all £750 per annum for the water privilege. It will, however, be necessary for the Commissioners to obtain more land before the whole power can be applied, and it may also be prudent for the present to restrict the sale of leases to five privileges of four runs, equal to 20 runs in all, until it is seen how the canal can be regulated for the navigation with so much surplus water passing round the locks.

I have the honor to be, Sir,
Your obedient servant,

(Signed) SAMUEL KEEFER,
Chief Engineer, Public Works.

No. 5.

COPY of a part of Chief Engineer's Report which is attached to Report of January 15th, 1851, approving of the lease of all the land and water.

Hydraulic Privileges, Lachine Canal.

In consequence of it having been intimated to the Department of Public Works that certain parties at Montreal are desirous of purchasing the right of using all the waste land and surplus water disposable at the St. Gabriel Lock, it is respectively submitted that no objection appears to present itself to carrying out such an arrange-

ment, provided that the following conditions, in addition to these already specified for granting the privilege separately be complied with.

* * * * *
Upset rental for the whole privileges £500 per annum on the conditions above specified.

(Signed) SAMUEL KEEFER.

No. 6.

EXTRACT from a Report, on water-powers Welland Canal 28th June 1847, by the Chief Engineer, when Engineer of that Canal, with reference to leasing to Companies exclusive privileges.

"I am aware that a proposition has been made to the Government, on behalf of a company, to be formed for that object, to buy out the whole of the water-power; and if it can be satisfactorily proved that the power would sooner be brought into use, without at the same time producing any inconvenience to the navigation, by committing it to the management of a company, it would undoubtedly be good policy to do so.

"But the history of this canal teaches otherwise. And experience has proved that it is a dangerous thing to create an exclusive interest upon the canal, at variance with the interest of the navigation. It was for this reason that the Welland Canal Company were at length compelled to buy out the old Hydraulic Company, which for several years enjoyed a right to all the surplus water of the Canal.

"For the encouragement of individual enterprise there is nothing to prevent the Government selling privileges at least as cheap as a company could afford to sell them, and it is not unreasonable to suppose that capitalists would prefer taking a lease from the Government direct, rather than from an intermediate party, whose interest it must be to make large profits out of the sub-division of the power."

APPENDIX D.

VALUATION of the Government Land, now leased to Hydraulic Lessees, upon the Lachine Canal, at its present value at Public Auction.

MONTREAL, 18th February, 1881.

DEAR SIR,—I beg to amend my valuation. The lots on Mill Street I value at 80 cents per square foot. The lots south of Mill Street, *i. e.*, between that and the river, will only be valuable when filled up and wharf is built, I therefore cannot place a higher value on them than 25 cents per square foot.

The land known as "Tate's Dry Dock," is only saleable as land at 20 to 25 cents per square foot at present. The St. Gabriel property I repeat my former estimate of, *viz.*, \$1.00 per square foot, and as regards the Cote St. Paul property, I also repeat my valuation of 15 cents per square foot. These valuations are, as requested by you, estimated as the value of the land at public auction apart from any other consideration. I enclose plans, and hope that the information will be satisfactory.

Yours respectfully,

THOMAS J. POTTER.

R. C. DOUGLASS, Esq.,
Department of Railways and Canals, Ottawa.

APPENDIX E.

No. 1.—TABLE of Wheels, Sluices, &c, &c., and approximate capacity of discharge therefrom at the different Hydraulic Lots, Basin No. 2.

I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.
No. of Lot.	Lessee.	Amount Leased.	Description of Wheels and Size.	Dimensions of Gate Opening	Area of Gate Opening sq. inches.	Head.	Quantity of Water discharged c. ft. per second.	Total quantity discharged.	Total quantity leased.
1 & E½-2.....	Frothingham & Workman...	None.....							
W½-2, 3 & 4..	W. P. Bartley & Co...	4 runs from lots 5, 6 & 7.	Sampson 3, 0 do 4, 0	..... .....	130 10, 3 280 10, 3		14 30	44	24
5 & E½-6.....	James McDougall.....	4 runs.....	Tyler 4, 6 do 4, 6 do 3, 0 Leffel 4, 6	18×19 18×19 14×20	342 9, 6 342 9, 6 280 9, 6		35 35 29 49	148	24
W½-6, 7, 8, 9 & 10.....	Peck, Benny & Co....	12 runs.....	Leffel 6, 0 C. Vent 5, 6 Tyler 6, 0 do 6, 0 Leffel 4, 8 do 4, 0	 11×34 16×30 16×30	374 9, 6 480 15, 0 480 14, 0		170 38 62 60 70 54	454	72
11.....	James McDougall.....	4 runs.....	C. Vent 4, 6 do do do do do do do 4, 10 do 4, 7 do do	9½×24 9½×24 8½×24 9×24 7×19½ 8×20½ 7½×20½	228 15, 0 228 15, 0 204 15, 0 216 15, 0 136 15, 0 160 12, 6 153 12, 6		29 29 26 28 17 20 20 18	167	24
12, 13 & 14..	Ira Gould.....	12 runs.....	Tylers 5, 6 do do do do do do C. Vent do do 4, 9 do 4, 6 do 5, 6 do do do do do do do do do do do do do do do do do do	8½×20½ 8½×20½ 7½×20 7×20 7×20 7½×17½ 9½×22½ 10½×22 9½×22 9½×22 10×22 10½×22 10½×22 10½×22 10½×22 10½×22 10½×22	174 19, 0 174 19, 0 150 19, 0 140 19, 0 140 19, 0 130 19, 0 219 15, 0 231 15, 0 209 15, 0 209 15, 0 209 15, 0 220 15, 0 231 15, 0 231 15, 0 231 15, 0 231 15, 0		25 25 22 20 20 20 20 19 28 30 27 27 27 28 30 30 30 30	408	72
15 & 16.....	Pillow, Hersey & Co.	8 runs.....	C. Vent 3, 2 Tyler 5, 0 do 5, 6 C. Vent 5, 2 Tyler 4, 6	15×22½ 18×22 18×24 9×24 17×18	337 15, 0 396 15, 0 432 15, 0 218 15, 0 306 16, 0		43 51 56 28 59	217	48
17.....	Wm. Lyman & Co....	4 runs.....	Leffel 4, 0 do 4, 0 do 4, 0 do 3, 4		259 16, 0 259 16, 0 259 16, 0 180 16, 0		58 58 58 38	206	24
Carried forward..		48 runs.....						1644	288

II. | VIII. | IX. | X.

ad.

10, 3	14		
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9, 6	35		
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15, 0	43	408	72
15, 0	51		
15, 0	56		
15, 0	28		
16, 0	39		
16, 0	56	217	48
16, 0	56		
16, 0	56		
16, 0	38		
		206	24
		1644	288

APPENDIX E.

No. 2.—TABLE of Wheels, Sluices, &c., &c., and approximate discharge therefrom at St. Gabriel.

I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Lessee.	Description of Wheel.	Dimensions of Wheels.	Square Inches of Gate Opening.	Head.	Quantity of Water discharged cubic feet per second.	Total quantity discharged.	Remarks.
		Inches.	Sq. in.	Ft. in.	Feet.		
Ogilvie & Co. ...	Leffel.....	60	.....	8 6	82		
	do	58	.....	taken.	69		
	do	56	.....	as	69		
	do	56	.....	8 0	69		
	do	56	.....	.....	69		
	do	48	.....	.....	41		
	do	48	.....	.....	41		
						440	
Green & Sons....	do	48	.....	.....	41		
						41	
Allen.....	Tyler	48	400	.....	38		
						38	
Ogilvie & Mc Leilan.	Leffel.....	60	.....	.....	82		
	do	48	.....	.....	41		
						123	
John McDougall	Tyler	60	400	.....	38		
						38	
John Smith.....	Leffel.....	48	.....	.....	41		
						41	
C. G. Holland...	do	48	.....	.....	41		
						41	
Fisher & Sons...	.....	60	500	.....	47		
						47	
Crathern & Caverhill.	Leffel.....	56	.....	.....	41		
	do	36	.....	.....	21		
						62	
R. Forsyth.....	do	56	.....	.....	69		
						69	
McDougall & Cowan.	Tyler	52	200	.....	19		
	do	52	200	.....	19		
						38	
A. Cantin	Leffel.....	72	.....	.....	120		
						120	
Canada Silk Co.	do	36	.....	.....	21		
						21	
John Ostell.....	Tyler	say 52	say 300	.....	28		
						28	
James Shearer ...	Leffel.....	72	.....	.....	120		
						120	
Moreland & Watson.	Jonval.....	60	600	.....	57		
						57	
J. A. Converse...	Leffel.....	72	.....	.....	120		
						120	
Total.....	26 Wheels....		Cubic feet per second.....			1444	

APPENDIX E.

No. 3.—TABLE of Wheels, Sluices, &c., &c., and approximate capacity of discharge therefrom, at Cote St. Paul.

harge therefrom

VIII.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
Remarks.	Lessee.	Description of Wheels.	Dimensions of Wheels.	Square inches of Gate Opening.	Head.	Quantity of Water discharged, cubic feet per second.	Total Quantity subleased.	Remarks.
			Inches.	Sq. in.	Feet.		Sq. in.	
	R. & J. Brodie, now Molson's Bank.	Wheels destroyed.	.....	.....	9	.....	1,500	Flour mill, from 1854 to 1874.
	Frothingham & Workman.	Tyler.....	72	1000	.....	.....	.....	Shovels and scythes, from 1854 to present.
		do	72	400	.....	.....	.....	First wheel uses $\frac{1}{2}$ gate.
		do	72	400	.....	90	1,800	
	Higgins & Co., or W. H. Warren.	Wooden, central discharge.	72	300	.....	.....	.....	Hammer factory, from 1854 to 1879.
		do	72	300	.....	.....	.....	
		Tyler.....	48	200	.....	80	800	
	P. Dunn.....	Wooden, central discharge.	72	300	.....	.....	.....	Horse nails, 1855 to present.
		do	72	300	.....	60	600	
	J. Dunn.....	Leffel.....	52	.....	.....	55	450	Cut nails, 1871 to present.
	Parkyn, now Ross, Hall & Co.	do	72	.....	.....	127	.....	
		do	72	.....	.....	127	.....	
		do	52	.....	.....	55	.....	
		do	52	.....	.....	55	.....	
		do	52	.....	.....	55	2,000	
	G. Gilmore.....	Tyler.....	72	400	.....	40	400	Auger factory, from 1860 to the present time.
	O. L. & R. S. Clarke.	do	42	150	.....	15	150	Sleigh bells, 1864 to the present time.
	Hutchins.....	do	72	500	.....	50	500	Spring and file factories, 1856 to the present time.
	Connolly.....	do	60	400	.....	.....	.....	Burnt down.
		do	60	400	.....	.....	.....	
		do	60	400	.....	.....	.....	
		do	60	400	.....	.....	.....	Was in operation 15 years
		do	60	400	.....	.....	.....	
		Roy .....	.....	400	.....	.....	2,000	
	Parton.....	Tyler.....	60	400	.....	40	400	Not in operation, was for 15 years.
	Total.....	17	.....	.....	.....	849	10,600	

APPENDIX F.

TABLE of Average Levels of Water during Season of Navigation and the Winter Season, of the River St. Lawrence at Lock No. 1, and Guard Lock; also of head and fall between river and canal at these places.

YEAR.	LOCK NO. 1.						GUARD LOCK.					
	Winter Season, average of 121 days, from 16th December to 16th April.			Season of Navigation, average of 244 days, from 16th April to 16th December.			Winter Season, average of 121 days.			Season of Navigation, average of 244 days.		
	Level of Water, Basin No. 2.	Average level of Water on the lower Mitre Sill.	Head, or Fall, be- tween the River and Basin No. 2.	Level of Water, Basin No. 2.	Average level of Water on the lower Mitre Sill.	Head, or Fall, be- tween the River and Basin No. 2.	Level of Water in Canal.	Average level of Water in River above Mitre Sills.	Head, or Fall, be- tween River and Canal.	Level of Water in Canal.	Average level of Water in River.	Head, or Fall, be- tween River and Canal.
	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft. in.	Ft.	Ft. in.	Ft. in.	Ft.	Ft. in.	Ft. in.
1852-53....	42 5	30 6	11 11	42 5	20 5	22 0	9	11 5	2 5	9	12 1	3 1
1853-54....	42 5	30 1	12 4	42 5	19 11	22 6	9	10 10	1 10	9	11 5	2 5
1854-55....	42 5	26 11	15 6	42 5	20 5	22 0	9	9 11	0 11	9	11 6	2 6
1855-56....	42 5	24 10	17 7	42 5	19 2	23 3	9	10 6	1 6	9	11 0	2 0
1856-57....	42 5	30 3	12 2	42 5	21 6	20 11	9	10 11	1 11	9	12 9	3 9
1857-58....	42 5	29 9	12 8	42 5	21 1	21 4	9	12 3	3 3	9	12 7	3 7
1858-59....	42 5	29 4	13 1	42 5	20 10	21 7	9	11 7	2 7	9	12 6	3 6
1859-60....	42 5	29 8	12 9	42 5	19 11	22 6	9	11 7	2 7	9	11 8	2 8
1860-61....	42 5	31 5	11 0	42 5	21 11	20 6	9	11 1	2 1	9	13 0	4 0
1861-62....	42 5	30 7	11 10	42 5	20 11	21 6	9	12 0	3 0	9	12 5	3 5
1862-63....	42 5	28 5	14 0	42 5	20 5	22 0	9	11 0	2 0	9	12 0	3 0
1863-64....	42 5	30 8	11 9	42 5	20 3	22 2	9	11 0	2 0	9	12 2	3 2
1864-65....	42 5	30 5	12 0	42 5	19 6	22 11	9	11 4	2 4	9	11 6	2 6
1865-66....	42 5	27 4	15 1	42 5	20 4	22 1	9	9 9	0 9	9	11 11	2 11
1866-67....	42 5	31 3	11 2	42 5	20 8	21 9	9	11 8	2 8	9	12 1	3 1
1867-68....	42 5	27 8	14 9	42 5	18 1	24 4	9	9 10	0 10	9	10 7	1 7
1868-69....	42 5	27 1	15 4	42 5	21 7	20 10	9	9 7	0 7	9	12 5	3 5
1869-70....	42 5	31 5	11 0	42 5	19 11	22 6	9	11 8	2 8	9	12 1	3 1
1870-71....	42 5	28 2	14 3	42 5	19 3	23 2	9	10 9	1 9	9	11 1	2 1
1871-72....	42 5	27 0	15 5	42 5	18 7	23 10	9	8 8	0 8	9	10 4	1 4
1872-73....	42 5	25 8	16 9	42 5	20 7	21 10	9	9 6	0 6	9	11 7	2 7
1873-74....	42 5	31 0	11 5	42 5	19 6	22 11	9	11 3	2 3	9	11 4	2 4
1874-75....	42 5	26 5	16 0	42 5	19 7	22 10	9	8 11	0 11	9	10 8	1 8
1875-76....	42 5	28 8	13 9	42 5	21 4	21 1	9	10 11	1 11	9	12 7	3 7
1876-77....	42 5	29 9	12 8	42 5	18 0	24 5	9	10 7	1 7	9	10 9	1 9
1877-78....	42 5	25 6	16 11	42 5	19 0	23 5	9	10 9	1 9	9	11 7	2 7
1878-79....	42 5	26 11	15 6	42 5	19 1	23 4	9	11 7	2 7	9	11 5	2 5
1879-80....	42 5	28 3	14 2	42 5	19 2	23 3	9	11 6	2 6	9	11 8	2 8
1880-81....	42 5	26 3	16 2	42 5	17 2	25 3	9	10 5	1 5	9	10 9	1 9
Average..	42 5	28 8	13 9	42 5	19 11	22 6	9	10 9	1 9	9	11 8	2 8

LACHINE CANAL.

Description of manufactures and machinery using Hydraulic Power, leased from the Government, Basin No. 2.

Number of Lot.	Name of Occupant.	Description of Manufactory and Machinery.	Rent.	Number of hands Employed.
No. 1 and E. ½...	Frothingham & Workman.....	No power used.....	\$ cts. 650 00	
W. ½ 2, 3 and 4..	King & Rodgers.....	Malleable Iron Works—lathes, drilling and boring machines.	1,128 00	50
do ...	Wm. Moulby.....	Grinding—Patent Roofing (both mills in construction).	.....	
No. 5 and E. ½ 6.	James McDougall.....	Flouring Mill—4 runs of stones and machinery.	645 00	10
W. ½ 6, 7, 8, 9 and 10.....	Peck, Benny & Co.....	Nail plate and spike rods—2 rolling mills.	1,725 00	160
No. 11	James McDougall.....	Flouring Mill—5 runs of stones and machinery.	430 00	0
Nos. 12, 13 and 14	Ira Gould & Co.....	Flouring Mill—11 runs of stones and machinery.	1,296 00	20
No. 15 and 16...	Pillow, Hersey & Co.....	Tack and Bolt Manufactory—10 bolt, 9 nut and 10 turning machines, 8 pointers, 20 threading, 7 tapping machines, 50 tack and nail machines, &c.	860 00	200
No. 17.....	Wm. Lyman & Co.....	Linseed Oil and Spice Mill—Paint and Putty Manufactory—3 runs of stones, 2 rollers, 4 presses, 10 chasers, 4 paint mills, 1 set rollers, putty mill and other machinery.	430 00	30
Nos. 18 and 19...	Montreal Warehousing Co	Flour Mill not in operation—(Grain Elevator uses power).	860 00	10
Dry Dock Lot....	E. Tate.....	Shipbuilding and repairing—2 circular saws, &c.	1,000 00	30
do, ...	Mooney & Co.....	Horse Nail Factory—40 nail machines.	.....	70
Total.....			9,030 00	586

LACHINE CANAL.

Description of manufactures and machinery, at St. Gabriel Water power; Rent, \$1,680. Young & Gould, lessees, now Ira Gould & Co.

Occupants.	Description of Manufactures and Machinery.	No. of Hands Employed.
Ogilvie & Co.....	Flouring Mills—32 sets of rolls, 8 runs of stone, 22 purifiers, 66 bolts, 2 smutters, 4 separators, 2 brushes and elevating machinery.	60
John McDougall.....	Foundry and Machine Shop—1 steam hammer, drills, lathes and general machinery.	250
John Smith	Agricultural Machinery—1 saw, 1 planer, 1 edger, &c.....	10
do	File Works—File cutters, trip hammers, &c.....	30
C. G. Holland.....	Felt Works—2 sets of cards, 3 felting machines, &c.....	30
Green & Co.....	do do do do	20
Montreal Woollen Mill.....	Low Woollens—4 sets double cards, 53 looms, 2,016 spindles.	150
Crathern & Caverhill	Nail Works—35 nail machines, 1 spike machine, shears, planers, drills, &c.	40
R. Forsyth.....	Granite and Marble Works—2 marble cutting machines, 4 polishing machines, 2 saws, 1 rubbing bed, 3 turning lathes, &c.	60
Montreal Blanket Works.....	Fancy Blankets, Suspender Web, &c.—2 double sets of cards, 18 looms, 480 spindles.	65
Wm. Johnston.....	Paint Manufactory—12 paint mills with other machinery, machine and tin-shop.	80
McDougall & Connors	Car Wheel Works—3 furnaces, &c., 1 fan.	50
A. Cantin.....	Ship-building and Repairs, Sash and Door Factory—Saws, planers and general wood-working machinery.	50
R. Ryle & Co	Silk Manufactory—12 looms, 2,000 spindles	50
W. Moccock & Son	Axe Factory—5 trip hammers, 6 grindstones, 2 pair shears, 5 polishers, &c.	25
John Ostell.....	Sash and Door Factory—7 saws, 4 planes and general wood-working machinery.	50
N. R. Mudgo.....	Roofing Material, Grinding, &c.....	5
James Shearer.....	Sash and Door Factory—Saws, planes and general wood-working machinery.	60
Moreland, Watson & Co	Saw Works—Grinding, cutting and polishing machinery, &c.	15
J. A. Converse	Rope and Plaster Mills—Cordage machinery and millstones.	200
	Total.....	1,300

LACHINE CANAL—Description of Manufactures and Machinery, at Côte St. Paul
Water-power; Rent, \$1,601. Wm. Parkyn, lessee, now estate J. Frothingham.

power; Rent,

	No. of Hands Employed.	Occupants.	Description of Manufactures and Machinery.	No. of Hands Employed.
purifiers, elevating	60	Montreal Blanket Co.....	Said to be the intention to extend or transfer from St. Gabriel— 5 sets double cards, 2,000 spindles, 100 looms.	250
ls, lathes	250	J. R. Hutchins.	File and Spring Manufactory—Trip hammers, file machines, shears, punches and machinery for making springs.	100
tc.....	10	E. Gilmour	Auger Manufacturer—Forging, file and polishing machines, trip hammers.	30
.....	30	O. L. & R. S. Clarke.....	Sleigh Bells, &c.....	15
.....	30	Ross, Hall & Co.....	Rice Manufactory—2 runs of stones, 5 mortars, 3 screens, 3 polishers and other machinery.	25
.....	20	Frothingham & Workman	Shovel Factory—Trip and drop hammers, grinding, polishing and punching machinery.	50
spindles.	150	P. Dunn.....	Horse Nails and Wire Staples—Presses and finishing machinery	15
e, shears,	40	J. Dunn.....	Cut Nails—30 nail machines, shears and general machinery...	55
achines, 4 3 turning	60	W. H. Warren.....	Hammer and Edge Tools—5 trip hammers, 4 presses and other machinery.	50
of cards,	65	.....	A Leather board Factory about to be constructed.....	.....
machinery,	80		Total.....	590
.....	50			
ry—Saws,	50			
.....	50			
r shears, 5	25			
eral wood-	50			
.....	5			
eral wood-	60			
hinery, &c.	15			
hillstones..	200			
.....	1,300			

OTTAWA, December 5th, 1892.

Hon. Sir CHARLES TUPPER, C.B., K.C.M.G.,
Minister of Railways and Canals,
Ottawa.

Sir,—

I have the honor to transmit, for your consideration, a confidential report upon the water-powers, under the control of your Department, on the Beauharnois, Cornwall, Williamsburgh and Welland Canals.

These, with previous reports, will enable you to form an opinion of the present condition of this branch of hydraulics, and the extent of the manufacturing industries established, upon the important links, in the Canadian water route from tide-water to the lakes, the St. Lawrence and Welland Canals.

The water-power, leased upon the subsidiary canals, is of small extent, and, at the present, is not of sufficient importance to be included in this series of reports.

I have the honor to be, Sir,

Your most obedient servant,

ROBERT C. DOUGLAS,
Assistant Engineer, Railways and Canals.

BEAUHARNOIS CANAL.

The Beauharnois Canal is situated on the south side of the River St. Lawrence 15 miles from the head of the Lachine Canal, and, by water communication, 23 miles from the city of Montreal. Valleyfield, at the head of the Canal, where the greatest power has been created, is distant $34\frac{1}{2}$ miles, by water, from Montreal, and Coteau, upon the opposite or north side of the River, where a bridge is to be constructed, that will bring railway communication to the doors of the mills, is 37 miles by rail from Montreal. The Canal is $11\frac{1}{2}$ miles in length, and connects Lake St. Louis and St. Francis, between which are three rapids, the Cascades, the Cedars, the Coteau. The rapids, and intervening stretches of river, have a fall of $82\frac{1}{2}$ feet, which, upon the canal, is divided into lifts of from 8 ft. to 11 ft., by 8 locks, and a small lift at the Guard Lock.

The area of supply, both for navigation and for mill purposes, is 84 sq. ft., or 6 openings of 4 ft. square, in the breast wall of the weir, less the area of sluice gates. At each lock there is a regulating weir to maintain the different levels of the Canal, and to pass the water which may be required for hydraulic purposes.

When the canal was first constructed, it was solely for navigable purposes. There were neither waste weirs at the locks nor a supply weir at the head. These formed a separate and subsequent contract, and principally undertaken for the purpose of developing the water-power on the canal, as the following extract from the Commissioners' of Public Works Report, for 1850, indicates:—

"Until these waste weirs are built, it will not be prudent to lease out water for machinery, except at the dam. The cost of these weirs is estimated at £9,790, and their construction strongly recommended at as early a period as the finances will admit of."

The cost of the weirs, when constructed, was about \$68,000; for this expenditure or that portion of it not chargeable to navigation, there has, as yet, been little return. There is only one mill privilege leased upon the canal, at \$120.00 per annum for four runs of stones.

The canal running through a farming district, no centres of population in close proximity, and no railway communication, there has been little demand for the power at the locks, which is consequently of less value than upon other canals more favorably situated.

Some 3,000 horse-power could be leased at the different locks without detriment to navigation. The total fall overcome by the canal is 82 feet 6 inches, and mill sites could be obtained at convenient positions near the locks, the head or fall at which varies from 8 feet to 11 feet. The value of power upon the canal proper should be \$10 per horse-power, including mill sites.

Several years after the construction of the canal, for the purpose of diminishing the current and raising the water on several shoals, at the upper entrance, one of the principal channels, and an opening between two islands of the River St. Lawrence, were closed by dams, which created a large water power at a short distance from the head of the canal, unconnected with it and with Lake St. Francis, or the River St. Lawrence, as a reservoir to draw from.

To effect the object contemplated—the improvement of navigation—there were two methods or projects, either to dredge a channel through the different shoals, or, to raise the water upon them by damming a section of the river. That the current was not very prejudicial and would not justify the large expenditure which has

Power created,
unconnected with
the canal proper.

resulted from the dam, is evident, from this quotation from the report of the Commissioners' of Public Works, for 1844:—

"Since the channel has been deepened, the objection to it, by those disposed to cavil, is chiefly that the current there is too strong and will prove inconvenient. The answer to which is, that the current is not within two miles an hour equal to that of several parts of the same navigation above and where no improvements have ever been contemplated or considered requisite; and there is every facility, at moderate cost, to stop the channel altogether below the entrance, by which the current would be almost destroyed, and a convenient and capacious basin created at the mouth of the canal. In the present state of navigation and trade generally, such improvement is not called for."

It will be shown that the improvements, necessary for navigation, could have been obtained at a much less cost than has resulted from the construction of these dams, consequently, this excess is directly chargeable to the water-power obtained.

In October, 1849, Mr. Alfred Barrett, Engineer, made examinations of these shoals, making soundings and borings. On the 30th he reported as follows:—

"I beg leave to report, for the information of the Department of Public Works, that I have concluded the soundings and the examination of the shoals in the channel at the head of the Beauharnois Canal.

"After completing the soundings, several borings were made, especially on the shoals at Black Pier and Red Lighthouse (the more difficult ones), all of which gave a soft blue clay mixed with stones, which will dredge well when the large stones are removed from the surface.

"I am satisfied that the dredge will operate well there, and that a channel may be speedily accomplished, and as early as required next season, if the work is promptly and thoroughly prosecuted."

On the 31st, he makes a supplementary report upon raising the water by dams, in which he estimates the cost of the dams, including land damages, at \$36,250. He states:—

"There are several objects to be considered in connection with this, and the question is, whether they are of sufficient weight to induce the expenditure necessary to effect the damming of the river now or in future."

He then details several advantages to be derived from the construction of dams with reference to increasing the depth of water upon the shoals. He states:—

"By the dams also will be gained an increased depth of water over the shoals of the basin, of probably one foot, consequently, a saving of expense in the deepening of the channel; yet I would not attach too high a value on this, as the saving would not exceed £1,000."

In the report of the Commissioners of Public Works for 1849, it is stated with regard to the Beauharnois Canal:—

"This canal, as well as that at Cornwall, has the requisite depth of water throughout its entire length, except at the entrance, where Mr. Keefer found only eight feet of water, and on the coffer-dam, where he found but seven. For the security of the navigation, it is indispensable to diminish the action of the current, and this can only be done by the construction of dams, the estimated expense of which is £6,400. The dams will have the double advantage of moderating the current, thereby diminishing the dangers of the entrance of the canal, and of raising the water in a place where it happens to be shallow and where accidents have already happened from the large boulders in the bed of this entrance."

The Chief Engineer of Public Works, in the appendix of the same report, states:—

"This canal has a full depth of water throughout, except at the entrance, where I found only eight feet, and on the lower coffer-dam where I found only seven feet. It is absolutely necessary to check the current at the head by constructing dams, which, with the dredging, will cost, per Estimate No. 1, £6,400. I recommend a contract to be entered into immediately for this purpose; and in consideration of the benefit to accrue to the Seignior of Beauharnois from the construction of the dams, the agent of the Seigneurs should be invited to co-operate and contribute."

Subsequent to the construction of the dams, the Engineer of Public Works reports:—

"These dams have had the double and desired effect of destroying the current, and raising the water over the shoals in that portion of the river between the entrance to the canal and Lake St. Francis, by which the entrance to the Beauharnois Canal is no longer a difficulty. They have also created a splendid bay and an extensive water power, which, situated upon a line of navigation of such magnitude, cannot fail to become at some future day the seat of varied and important manufactures."

The enlargement of the River St. Lawrence, known as Lake St. Francis, is caused by the contraction of the river at its foot, by numerous islands and by the natural dam, or ledges of rock, which generally form the head of rapids, these still further diminish the area of discharge. The effect of thus obstructing the discharge, closing an important channel, and interfering with the regimen of a river of the characteristics of the St. Lawrence, were serious. The water was raised in the lake, the shores being low-lying, many claims were made for damages to property, both by flooding and interference with drainage. Speaking in round numbers, some \$300,000 have been expended in connection with land damages, \$56,000 in works in reclaiming and protecting from being flooded low-lying lands. The dams themselves cost \$34,000—a total expenditure of some \$380,000 in the creation of this water-power.

Mr. Barrett stated the cost of obtaining the necessary depths through the shoals by dredging would be less than the cost of dams. The Engineer who constructed them could not have considered there would have been as large an expenditure as has been incurred. The actual cost of the dams themselves could be all that is really chargeable to navigation, or there would be say, \$350,000 as the cost of this water-power, exclusive of the hydraulic canals, head-gates, etc., at each end of the dam, which would be necessary to bring the full power into operation. This dam would give, say 7,000 horse-power, at a cost of \$50 per horse-power, or at 10 per cent. interest, including repairs and maintenance, would be \$5.00 per horse-power per year, as the cost of an horse-power before the water leaves the lake.

The water power became a subject of consideration to the Department. In December, 1850, a list was advertised defining the hydraulic privileges proposed to be leased upon the St. Lawrence Canals, in which occurs the following notice with regard to the water power created by the dam:—

"BEAUHARNOIS CANAL."

"5. A most extensive water power has been created by the construction of a dam across a branch of the River St. Lawrence, running between Beauharnois Island and the main south shore, situate opposite the guard lock at the upper entrance of this canal. The head and fall is fifteen feet—the supply is drawn direct from Lake St. Francis.

"The power created is equal to that of 5,000 horses and may be used summer and winter without interruption, being unconnected with the canal.

"The water is pure and well suited for the manufacture of paper, or other manufactures requiring abundance of pure water. The distance from Montreal is 40 miles; the situation is healthy, and the country around is fertile and well settled. It is upon a line of navigation unrivalled for cheap and speedy communication with eastern and western markets, and cannot fail, at some future day, to become remarkable for the extent of its manufactures. Several lots have been laid off for present accommodation, along with which water power will be let to any extent that may be desired."

There is the following extract from the Report of the Commissioners of Public Works for 1851:—

"In the previous reports of this Department, reference has been made to the advantages to be derived by this part of the Province from the almost unlimited

water-power created by these dams. One of the privileges has since been leased, upon which a paper mill, on a very extensive scale, is about to be established, and a large amount of capital employed. Two other privileges have also been applied for, and the Commissioners are encouraged to hope that the immense advantages of this position will soon be appreciated, and fully realized. It will be necessary, in connection with these privileges, to excavate a canal or mill-race, which will be common to all the hydraulic lots, and to construct a permanent set of head-gates to secure the dam from accident, as well as to place the control of the water entirely in the hands of the Commissioners. The cost of these works is estimated at £1,500."

The large annual expenditure upon this power is seen from extracts from Departmental Reports extending over a series of years.

Annual expenditure upon the maintenance of the water-power.

Commissioner of Public Works Report for 1855:—

"The works of the dyke near the head of this canal, the construction of which was considered necessary to prevent the water of Lake St. Francis from flowing over a large tract of low land in that locality, and to cover the cost of which an appropriation was made, are advancing satisfactorily. The result of this dyke or embankment will not only be to do away with all future claims for damages by the flooding, whether real or imaginary, but will be the means of reclaiming and rendering valuable an extensive tract of land heretofore worthless, and will form a direct line of communication to the western townships."

The Report of the Commissioners of Public Works for 1856:—

"The dyke at the head of this canal, alluded to in the previous report, has been completed, and fully answers all the purposes contemplated in its construction. It not only prevents the river water from flooding the low land to the south, but it has been the means of rendering useful several thousand acres of the Seigniorie, hitherto considered worthless and unprofitable, due credit for which should be given in the arbitration for claims set up by the Seigniors for compensation."

Report of the Superintendent for the year ending 31st December, 1860:—

"The dams at the head of the canal have received constant attention; but in consequence of the low water, the repairs have been less than in 1858. The severe gale and storm of the 23rd and 24th of November last, caused extensive damages to the dyke on Grand Isle, above the main dam, and to portions of the dyke through Hungry Bay. These dykes must be repaired early in the season, to prevent the river water from flooding the lands, and causing new claims for damages."

The Report of the Commissioner of Public Works, for the year 1861:—

"The dam at the head, from frequent settlements taking place in it, continues to require constant attention and repairs."

"These, together with the protection of the dyke at Grand Isle (one mile long,—exposed to the action of the surf), and the dyke through Hungry Bay (nearly five miles in length, one-third of which is exposed to the surf), have swelled the outlay for maintenance beyond the sum ordinarily expended for that purpose."

Report of the Superintending Engineer for year ending 31st December, 1861:—

"The cost of repairs on this canal has been much larger than was anticipated, caused in part by the large increase in the trade and by the freshets of last winter and almost constant rains during a large portion of the summer, which had the tendency to soften the bank, causing slides in the outer slopes and injury to the slope walls, and clogging up the ditches. That portion of the dykes on Grand Isle and through Hungry Bay, which was nearly destroyed by the storms of November, 1860, has been thoroughly rebuilt and well protected with stone; they are now in good order."

Report of the Commissioner of Public Works, for 1863:—

"This canal is the only one of the series which is located on the south shore of the St. Lawrence, it passes through a well settled part of the country, and is, consequently, crossed by a large number of swing bridges. These, together with the long dykes on both sides of its upper entrance, rendered necessary by the packing of the water there, considerably increase the cost of maintenance. Four thousand lineal feet of the dyke through Hungry Bay was raised last year for a height of about twenty

inches, and a like extent will have to be done during the ensuing season. The dam built across a branch of the St. Lawrence to deepen the upper entrance, requires constant care and watchfulness to maintain its efficiency."

Report of the Resident Engineer, for 1865:—

"The dykes on Grand Isle were maintained in good order. Some portions of the dyke through Hungry Bay were raised, and the inside lined with stone to protect it from the action of high water. Sink-holes continued to form in the dams, which required continual attention.

"The usual repairs to slope walls, bank, dykes, dams, ditches and culverts, must be made during the present summer, and about 250 lineal yards of the dyke through Hungry Bay raised, and the inner or bay side protected with stone."

Report by the Superintending Engineer, for 1870:—

"The dykes and dams connected with the upper entrance of this canal and through Hungry Bay, which were seriously damaged and washed by high water during the early part of the season, were repaired and protected with stone."

Report of the Engineer in charge, for 1875:—

"At the upper entrance 420 lineal yards of slope wall were rebuilt. The lower dam at Grand Isle and the dam at Cat Island were repaired, and several bad leaks stopped in each.

"The dyke at Hungry Bay was faced with stone for a length of 260 yards on the north side, and 20 yards on the south side. Three miles of it, used as a road, were raised with stone and gravel, and otherwise repaired."

Report of the Engineer in charge, for 1876:—

"The protection pier and wharf at the upper entrance was repaired. The dams and the dyke at Hungry Bay were damaged by high water in May and June. The dams have been repaired, but the dyke at Hungry Bay still requires to be raised and protected at several points."

The foregoing demonstrates that \$5.00 per horse-power, per annum, as arrived at previously, is a moderate estimate of the annual cost of this power. If the work had been undertaken by a company for that purpose, adding to the original cost, that chargeable to each horse-power, in conducting the water from the lake to the head races of the mills, it would give power at a cost which would be a profitable investment. As the manner in which the power has been developed affords much less power than the amount taken, 7,000 horse-power, each horse-power used, or leased, represents a greater cost to the country than the amount above taken.

West Side of Dam.

Applications having been made for power, upon the west side of the dam, a supply weir and raceway were constructed and seven hydraulic lots laid off.

I am unable to determine the expenditure upon this side; the area of supply was, presumably, sufficient to furnish the power intended for each lot—six runs of stones, or 420 horse-power for the seven lots. Lots Nos. 1 and 2 were granted to F. X. Poitras, in 1854; his rights were assigned to P. Poulin, to whom a lease was granted for the lots, and power equal to twelve run of stones, in December, 1861, the lease dating from October, 1854. These lots are now in the hands of other parties.

In 1866, Messrs. Anderson & Wattie, and Mr. Parham, applied for lots, the Engineer of the Canal reporting favorably. In 1868, William Miller applied for lots Nos. 3, 4, 5, 6 and 7, upon which the Engineer reported favorably. In 1872, Messrs. Anderson & Wattie, the occupants of lot No. 2, upon which was erected a woollen mill, again applied for a lease of lot No. 3, under the same conditions as lots Nos. 1 and 2 were leased, and the rent offered the same. This application was reported upon favorably, by Mr. Sippell, Engineer of the Canal, who states that these gentlemen have done much towards building up the village, and deserve every encouragement. On the 7th September, 1872, an Order in Council was passed, granting them the lease of lot No. 3. In August, 1872, T. F. Miller made an application for the unoccupied lots at this place. There seem, at the same time, to have been other

parties desirous of obtaining these privileges, as he writes several letters with reference to the machinations of other parties, and to prevent a clear imposition from being practised upon the Department.

On the 26th September, 1872, W. Hobbs transmits a memorial from certain parties who intended to form themselves into a company, known as the Montreal Cotton Company, for the manufacture of cotton fabrics, in Lower Canada. He informs the Department that the whole area of the five lots would be required. Mr. Hobbs states that incidentally he had learned "that another party had applied for one of the lots required by us." The lease for this lot had already been granted by an Order in Council, but not executed. This letter was formally acknowledged by the Department and filed. In August, 1873, A. Cross and W. Hobbs, on behalf of the Montreal Cotton Company, write, asking the terms upon which the Government will grant the power; this letter is referred to the Engineer of the Canal for report, and on the 9th October, 1873, he reports in favor of the application, and recommends, that if the Government constructs the head-race and other necessary improvements, the lessees to pay interest upon the expenditure and \$1.00 per horse-power per annum, but if the lessees construct the head-race, the rent to be the same. On the 22nd December, 1873, an Order in Council was passed, authorizing the lease of these privileges. In January, 1874, Messrs. Anderson & Wattie, who had been granted lot No. 3, renewed their application, but were informed by the Department that the lot had been already disposed of to other parties. In March, 1874, the lease to the Cotton Company was executed. There seems to have been considerable competition for these lots, but they were not put up at auction as was the custom of the Department in the original leasing of water-powers when there were several applications for the same property.

The first Order in Council authorizing the sale of power was founded upon the following report:—

"The Chief Commissioner of Public Works has the honor to report that there is an unlimited supply of water power, which has been recently created by the construction of a dam at the upper entrance Beauharnois Canal, which in his opinion it would be for the public interest, should be as early as possible employed in various useful manufacturing purposes; and with this view the undersigned respectfully suggests Your Excellency's sanction be granted to dispose thereof from time to time, at public auction to the highest bidder, above a certain price (to be fixed by the Department) per run of stones or power equal thereto. The lease to be under the same restrictions and for the same period as other Provincial canals."

19th March, 1852.

In the connection to this Company, there is the inception of a monopoly which may cause trouble in the future. Their rights should be definitely established or there may be another hydraulic company added to the list,—an account of which is given in other reports.

The Government has acknowledged some right to the water flowing through this race, irrespective to that used in the manufacture of cotton, by the fact that the lease to J. McDonald, 6th July, 1881, requires the lessee to obtain permission from the Cotton Company for the water necessary to run his mill. He is granted a mill site with four run of stones at a rental of \$20 per annum. He informed me that he pays \$200 per annum for 60 horse power to the Cotton Company, or nearly \$3.50 per horse-power, for which they pay nothing to the country. This Company have obtained possession of almost every foot of Government land on the west side, they have bought adjacent land and the frontage of the old channel of the river, for some distance from the dam, thus obtaining the only position where an hydraulic canal could be excavated and mills erected between it and the old channel. The object in acquiring this frontage, for such a distance, must have been for some purpose of this kind. Upon the opposite side of the dam, which cannot have much connection with

their manufactory, they have acquired a piece of land which cuts off the lessee upon that race, and the Government from extending it any distance down.

That the Company, in 1876, considered the Government had the right to lease the water, is shown by the following quotation from a letter to the Department from A. Cross, vice-president of the Company:—

"The Government have a decided interest in the preservation of their roadway of 40 feet in width. Besides having their access to control and regulate the water supply and works, as expressed in the leases; by its being kept open the expected facility is afforded to those who would avail themselves of further water-power on the hydraulic lots to the east of the Cotton Company's mills, and would increase the revenue of the Government therefrom, which is regulated by the quantity of water used, while, without this facility, the water in question would be less likely to become available."

In contradistinction to the value of this road as set by the vice-president of the Cotton Company, in 1876, there is the following application of the Company through its secretary, made in December, 1880:—

"A roadway forty feet in width has been reserved by the Government, running across the entire length of the said lots, and whereas the use of the said roadway will not be required by the Government in the future, and as such reserve has become a nuisance to this Company by reason of a public thoroughfare being made thereof to the possible danger and damage to the mill buildings, the property of this Company, the directors hereby request that the said right of way may be withdrawn and that permission be given by the Government to this Company, to inclose and fence in the said hydraulic lots before referred to, (including the said roadway), in any manner and at any time they shall consider necessary or desirable so to do."

If the Government permit this Company to sub-lease water, above what will be required for their cotton factory, it is evident that they should not be allowed to have this power at the same rate, 50 cents per horse-power, which they will pay for over 800 horse-power used in the manufacture of cotton.

The clauses of the lease give them surplus water not required to maintain Lake St. Francis at navigation height, and the quantity that can pass through a raceway 100 feet wide and 10 feet deep. In order to draw down Lake St. Francis to its level, previous to the construction of the dams, the quantity of water discharged should be equal to that which passed through the channel before it was closed, which might or might not be the case, the character of the discharge of the lake at this place having been changed. This quantity is indefinite, the section of channel and velocity stated in reports would give some 20,000 effective horse-power from the amount of water passing through it.

The mean velocity which will be allowed in the race-way is not stated, by a properly constructed race way of these dimensions they might draw water sufficient to give 6,000 effective horse-power, all of which, not required for their own mill might be sub-leased, the Government receiving only 50 cents per horse-power for what has cost the country \$5 per horse-power at the dam. The difference between 50 cents, with the interest of the capital, required to bring the water to the head-race of the mills, added, and the amount they would receive from their sub-lessees, being profit to the Company.

The expense to which the Company have gone in re-constructing the weir and excavating a channel into the lake, I am not aware of. It has been stated that the work was done very cheaply. They constructed a coffer-dam and excavated a quantity of rock which was used in the construction of the mill; this is said to have been as cheap a method of obtaining material for building as that of quarrying and hauling the stone. We will say that the Company extended their head-race eastwards a sufficient distance to utilize 6,000 horse-power, and that the cost, including the amount already expended, to be \$90,000, or \$15.00 per horse-power, which, at 10 per cent. per annum, would be \$150 per horse-power. If the Company, when the addition to the mill is completed, utilize all the power their wheels will give them, including the power other lessees on this side are using, it will amount to nearly 1,750

horse-power. In this case they might sublease 4,250 horse-power, which would cost them only \$2.00 per horse-power.

This is the most valuable power along the whole line of canals. It is not subject to navigation, the water is not drawn off every year for repairs, there is but little back water, and with slight improvements to the channel into which the tail water is discharged, there could be no finer power found in any locality. There is a never failing supply of water, constant head summer and winter, requiring no auxiliary engines as at other mills upon the canals.

When the Canada Atlantic Railway is extended across the river, this power should be worth \$12.00 per horse power per annum. If the cost of the power to the country, at the dam, \$5.00 per horse-power, was paid by the Company, adding the \$1.50 expended by the Company, they might in the near future make a profit of \$5.50 per horse-power per annum by sub leasing; each horse-power, by the present lease, would represent \$2.00 per annum, which would give a profit of \$10.00 per horse-power per annum.

The application for this grant was made upon the grounds of encouragement to cotton manufacture in Lower Canada, and no doubt upon this consideration it was granted at these low rates, which include the valuable mill site belonging to the Government and which the Company occupy. Under a protective tariff the conditions are changed, the grant becomes a protection in favor of this mill and against all other cotton manufactories in the country, which are using steam power, paying a higher rental for water power, or using power of less value.

In December, 1880, the secretary of the Company, in behalf of the directors, brings before the Department certain facts, viz.:—

"That the Canada Cotton Manufacturing Company, at Cornwall, in the Province of Ontario, with which Company we have to compete in the manufacture of cotton goods, has been granted the privilege of drawing water from the Cornwall Canal for the purpose of supplying motive power at their mill, and without any charge being made therefor, such supply being taken at a point to which it has cost the Government a large expenditure in money to bring it. Whereas in the case of the 'Montreal Cotton Company,' the Government has done nothing whatever, nor has it been put to any kind of expense in providing the Company with the water required to create the motive power at the mill, which water supply is drawn from Lake St. Francis on the River St. Lawrence, still the Company is charged with an annual rental for the use of the water at Valleyfield."

This statement is not correct. As has been shown, the power costs the country as much at this place as at Cornwall. The Canada Cotton Company will only use a small proportion of water power, the balance being furnished by steam. The proportion of water-power used does not yield much revenue to the country, but no doubt they pay to the lessee, George Stephen, for their mill site and water-power, a larger rental than the Montreal Cotton Company are contributing. The Canada Cotton Company have had to purchase their own mill site, while in the case of the Montreal Cotton Company this is practically given them. In addition, at Cornwall they are troubled with back water in winter, to that extent, that the power is of less value, having to pay the interest upon engines, boilers, &c., as well as the greater cost of production from the proportion of the power furnished by steam. We have, therefore, a protection in favor of the Montreal Cotton Company in the cost of mill site and water used, and a greater protection for each horse-power of steam it is necessary to use at Cornwall. The Stormont Cotton Company are paying \$3.00 per horse-power. If the Government required them to pay the same rates for the excess of power used above that leased, they would be paying higher for a less valuable power.

These facts are stated and approximate figures taken for exemplification of what may occur in the future. Several clauses in the lease may protect the Government, as:—

"The said water to be used for cotton mills, or machinery approved."

"That the water so leased by these presents, shall not include other water than that passing on the westerly side of the above mentioned dam."

"That the quantity and extent of the water to be used at any time shall be subject to the approval of the Minister of Public Works."

"That the granting of this water privilege shall not be construed as depriving the Government of the right to grant leases to other parties, of surplus water, other than hereby leased, although obtained from Lake St. Francis, in this locality."

These clauses are of little value, as the Company have obtained possession of nearly all the Government land on the west side. They have bought all the available mill sites below the Government lots, and upon the east side of the dam, have purchased property which blocks the extension of the raceway upon that side, and by securing the situations favorable for utilizing this power, they have, virtually, a monopoly of the power, not alone on the west side, but of the whole dam.

The last clause has been to a certain degree abrogated by McDonald being required to lease power from the Company.

East Side of Dam.

To develop the power upon this side, the Department, in August, 1853, placed under contract, for construction, a weir and raceway to supply the water to the five mill lots which had been laid off. The power, (160 horse power), leased on this raceway, is now used in the manufacture of paper, under the firm of A. Buntin & Co., for which they pay \$792.00 per annum, or, nearly \$5.00 per horse-power, but they are using, in excess of the powers leased, an amount which gives them their power at less than \$1.50 per horse-power.

This weir and raceway cost \$14,254, which, at 10 per cent., represents \$1,425 per annum, for which is received \$792. This expenditure was purely for the benefit of the lessee, and if we add the cost, assumed, of the water at the dam, \$5 per horse-power, they would require to pay \$7.50 per horse-power for what they now use, or \$1,325 per annum, to cover the cost of the power.

The sluiceways in the weir are of insufficient area to admit the quantity of water discharged by the wheels without drawing down the level of the head-race, to an extent, which reduces the head and power. Their wheels are set too high, causing a greater consumption of water than necessary, they wish the Government to provide them with an additional means of supply.

In these remarks I have taken 7,000 horse-power as the power which could easily be utilized at this dam; the power, the wheels which are, or shortly will be, in use, affords, would give \$15.00 per annum as the cost to the country of each horse-power used, before it leaves Lake St. Francis: on the east side of dam to this amount must be added \$2.50 per horse-power, expended upon the race to the paper mill, or \$17.50 per horse-power per annum for the water supplied to A. Buntin & Co., for which \$1.50 per horse-power is received as rent.

The present rent on lots Nos. 1 and 2, on the west side, is \$2.00 per horse-power for amount leased,—\$1.00 for quantity used. Lots Nos. 3, 4, 5, 6 and 7, \$1.00 per horse-power up to 800 horse-power, and 50 cents for each subsequent horse-power.

East side, lots Nos. 1, 2, 3, 4 and 5, \$5.60 per horse-power for water leased, and \$1.50 per horse-power used.

This power is especially adapted to the manufacture of cotton, or other manufactures, which employ a large number of operatives, the power being steady and constant, not liable to stoppage, which is a serious loss where a large number of people are thrown out of employment, and perhaps skilled labor dispersed, to the detriment of the employers of the labor.

Whatever policy may be adopted with reference to this power, it would be well that the control of it should not be permitted to drift into the hands of middlemen, and that any power leased or brought into effective use should return a revenue equal to the large expenditure made in creating it.

Appended, is a table from which the class of water wheels in use, character and amount of machinery in operation, number of hands employed and other information, may be obtained.

BEAU HARNOIS

Table of Water Wheels, Approximate Discharge of Water and Number of Horse-powers

Name of Lessee.	Name of Occupant.	Situation of Mill.	Date of Lease.	Term of Lease.
		<i>East side of Dam.</i>		
A. Buntin	A. Buntin & Co.	Lots Nos. 1, 2 and 3.	June 25, 1867	21 years, from Jan. 1, 1856
do	do	Lot No. 4.	do 25, 1867	do Jan. 1, 1867
Stephen May	do	Lot No. 5.	May 16, 1856	do July 1, 1855
do	do .....	.....	.....	.....
do	do .....	.....	.....	.....
		<i>West side of Dam.</i>		
P. Poulin	Anderson & Son and Anderson & Wattie	Lots Nos. 1 and 2.	Dec. 21, 1861	21 years, from Oct. 1, 1854
do	do .....	.....	.....	.....
do	do .....	.....	.....	.....
do	do .....	.....	.....	.....
do	do .....	.....	.....	.....
Montreal Cotton Co.	Montreal Cotton Co.	Lots Nos. 3, 4, 5, 6, 7.	Mar. 6, 1874	21 years, from Jan. 1, 1874
do	do .....	.....	.....	.....
James McDonald	James McDonald	Between Lot No. 1 and Dam.	July 6, 1881	21 years, from July 1, 1881
do	do .....	.....	.....	.....
Joseph Meloche	Joseph Meloche	Lock No. 7, Canal proper.	June 3, 1869	21 years, from July 1, 1869
do	do .....	.....	.....	.....

CANAL.

used and Machinery in the Mills of Hydraulic Lessees, Valleyfield, and Lock No. 7.

Description of Mill.	No. of Runs of Stone Leased.	Yearly Rental.	Character and amount of Machinery in Mill.	Number of Hands Employed.	Description of Water-wheels in Use.			Head, Water Discharged, Power Used and Leased.			
					Maker.	Name.	Number. Size or Diameter in inches.	Head in feet.	Cubic Ft. discharged per Second.	H. P. taken at 75 p. c. for useful effect.	H. P., 75 p. c. for useful effect leased
		\$ cts.									
Paper Mill...	6	354 00	20 engines.....	200	Holyoke Machine Co.	Hercules	2 48	10-0	243		
do ...	6	318 00	11 beaters, 8 washers.			Leffel ...	3 48	10-0	137		
do ...	4	120 00	1 Jordan			do ...	2 40	10-0	63		
do ...						do ...	2 56	10-0	155		
do ...					McDougall Montreal.	Jonval..	1 60	10-0	85	580	160
Saw Mill.....	12	240 00	1 circular saw, 1 planing mill and general wood-working machinery.	65	do ...	Tyler ...	1 48	12-0	42		
do						Leffel ...	1 40	12-0	35		
Flour Mill ...			5 runs and machinery.	2		do ...	1 26	12-0	75		
do ...						do ...	536	12-0	26		
Woollen Mill ...			3 sets manufacturing cards, 1,000 spindles.	60		do ...	56	12-0	84	267	120
Cotton Mill .	*	†400 00	65,000 spindles, 1,800 looms.	1,300	Holyoke Machine Co.	Risdon..	3 84	13-0	512		
do ...						Hercules	4 54	13-0	740	1,383	†
Flour Mill ...	4	20 00	4 runs and machinery.	4	Wilson & Co., Picton.	Little Giant.	30 24	10-0	73		
do ...						Tyler ...	1 20	10-0	7	67	40
Flour Mill ...	4	120 00	4 runs and machinery.	2	McDougall, Montreal.	do ...	1 54	9-0	43		40
do ...						do ...	3 42	9-0	80		90
Total.....		1,572 00		1,633			34			2,387	

* No of runs indefinite.

† Amount paid at present.

‡ Power to be used.

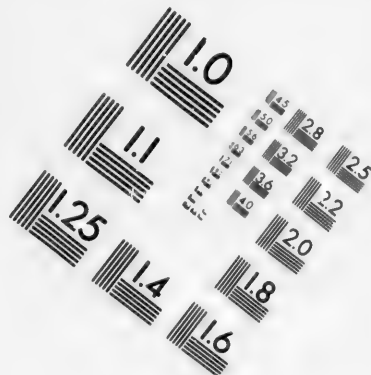
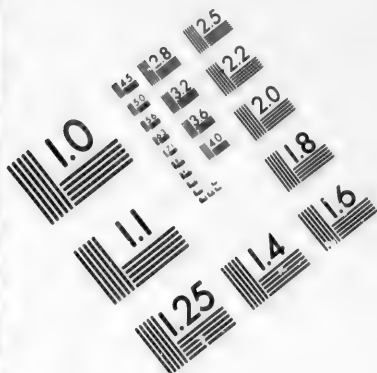
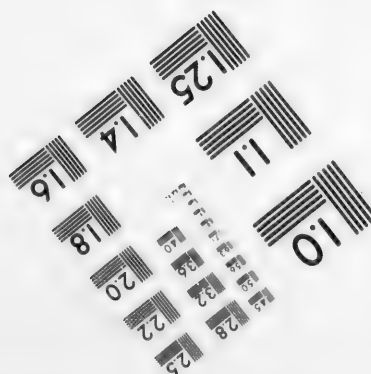
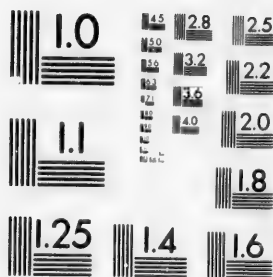


IMAGE EVALUATION TEST TARGET (MT-3)



1.5 2.8 2.5
3.2 2.2
2.0

10

CORNWALL CANAL

From the head of the Beauharnois Canal to the foot of the Cornwall Canal the distance is $32\frac{3}{4}$ miles. In the general Report upon Public Works, the distance from Montreal by water communication is stated to be $67\frac{3}{4}$ miles. The distance by railway communication, Grand Trunk, 67 miles. The Canal is $11\frac{1}{2}$ miles long; the total fall is 48 feet, which is known on the river as the Long Sault Rapids. The supply of water at the head, both for navigation and mill purposes, is discharged through 6 sluiceways, 4ft. x 3ft., in the breast wall of the supply weir, or less the sluice gates, a total area of 60 sq. feet.

There is an additional area which varies according to the height of the river, flowing over the weir, the crest of which is 7ft. 2in. above the mitre sill, guard lock, and 34 feet in breadth. It is also found necessary in certain stages of the water, to use the valves in the gates, an area of 32 sq. feet.

At each lock above the Cornwall Level there are regulating weirs of sufficient area of discharge to supply the large quantity of water used by the mills upon that level.

The sectional area of the water prism is greater than upon the other un-enlarged Canals. The areas given are not the sections the canals have assumed, but as they were originally constructed. Williamsburgh Canals—sectional area, 700 sq. feet; Beauharnois Canal—1,000 sq. feet; Cornwall Canal—1,250 sq. feet. At any determined velocity, this canal will pass a greater volume of water with the least detriment to navigation. A power of some 4,000 H. P. might be obtained, if the area of the supply at the head was adequate to discharge the amount of water required. The current, caused by water drawn necessary to give this power, would not be prejudicial to vessels.

The water-power upon this canal is created by a fall of 48 feet, overcome by the various locks. At these locks the head, or fall, is 8 feet each; at the lower end of the canal, three locks being in close proximity, the tail-races of the mills discharge into the river, between which and the Cornwall Basin the average head and fall varies in the summer season, from 21ft. 0in. to 23ft. 6in., and in the winter season from 12ft. to 20ft. 6in.

The usual expenditure, upon account of water-powers, has been made upon this canal, the rents received being in no proportion to the interest upon the outlay. The following extract from a document issued by the Department of Public Works, in 1850, refers to this expenditure:

"Other privileges for milling and manufacturing purposes will be at the disposal of the Government at each of the locks on the canal, after weirs, around these locks, have been built."

One of the first leases of power was made with the Hon. P. Vankoughnet, in 1847, who leased 12 run of stones to be used upon his own property, known as Lot No. 7, in the Township of Cornwall. The terms were \$80 for the first run, and \$40 for each subsequent run, that is \$4.33 per horse power per annum. On the 1st June, 1857, the amount of power was extended to 20 runs of stones, at a rental of \$3.00 per horse-power per annum; the 21 years term dates from 1857. An extension of four years, from that date, was given for the erection of the necessary machinery to utilize the power. On the 13th July, 1857, the property, together with the water-power, were transferred to Wm. Mattice. He states that he paid \$3,000 for the land, and \$10,000 for the water-power, in cash. In September, 1858, a contract was made between the Department and the Lessee, to construct the supply weir, head-gates, &c., for supplying the water leased. This weir, purely for the benefit of the lease, cost something over

\$6,000, or, at 10 per cent., would represent a rental of \$600 per annum, to cover this portion of the expenditure.

On the 19th March, 1861, an indenture was made between W. Mattice and William Mack, whereby a mill-site and 30 horse-power was sub-leased to the latter, at a rental of \$5.00 per horse-power. On the 12th March, 1866, a further agreement was drawn up sub-leasing 10 horse-power additional, in all 40 horse-power, the rent to be \$4.75 per horse-power.

On the 24th November, 1864, an indenture was made between W. Mattice and Lawrence Ballard, for a site for a pottery and 10 horse-power at a rental of \$15.00 per horse-power.

The original lease of the Hon. P. Vankoughnet contained a clause that, until the expiration of the period when the full power should be utilized, rent should be paid for the power as it was brought into use. Mr. Mattice was paying a rental of \$135.00 on the 50 horse-power he had sub-leased. The date having transpired, within which he was required to bring the 200 horse-power into effective operation, he had actually forfeited his rights to 150 horse-power although no formal action had been taken. The Solicitor General reported that the assignee of the lessee having failed to occupy a portion of the water-power within the granted time, upon due notice being given, an end would be put to the right of the tenant, to draw more water than he had been consuming up to the date of notice.

Mr. George Stephen made application for water-power, for the purpose of erecting a woollen factory, requiring 160 horse-power. He was informed by the Commissioner of Public Works, that he had decided to grant him the whole of the unappropriated water-power upon the Cornwall Canal, to be used upon the Government land. The Chief Engineer to the Department, upon former applications for power, having previously reported strongly against leasing any more water upon this level, as it would cause a permanent injury to navigation, Mr. Baillairgé, at the date of these negotiations, also reported that "there is no more power than leased upon this level;" it was proposed to lease the power Mr. Mattice had forfeited, which he protests against, as he had paid a large sum for the power and also expended \$5,000 upon raceways, &c., he offers the unoccupied power and two acres of land as a bonus to Mr. Stephen or any other responsible party, for the sum expended, \$5,000. He states he had made every endeavor by advertising and otherwise, to bring the whole power into use, but, owing to dull trade, high rate of interest, and the war in the United States, he had been unable to accomplish his object.

An agreement was entered into, subsequently a formal indenture was drawn up on the 13th June, 1866, between William Mattice and George Stephen, in which the former conveys to the latter two lots, or about eight acres of land and all the water privilege he held from the Government, for \$6,500. Indentures were drawn up, conveying for five shillings each and other considerations, the sub-leases of Mack and Ballard.

In August, 1866, an order was passed, granting Mr. Stephen 200 horse-power for \$1.00 per annum for the unexpired term of the lease. The lease was drawn up and the maximum rent to be paid was set at \$135.00 per annum—the amount at present paid.

The Chief Engineer of Public Works on the 7th December previous, reported:—"Mr. Stephen, or any other party, leasing the water-power at Cornwall, the creating of which has already cost the Government a very large sum (will no doubt do so with a view to their own special benefit), and should therefore, in my opinion, be bound to pay the full amount of rent conditioned in the lease to Mr. Vankoughnet, namely, \$600 per annum, which is extremely low for the privilege."

By this lease, the country lost \$134.00 per annum during the time \$1.00 per annum was charged, as Mr. Mattice paid \$135.00 for the 50 horse-power leased, for which he and Mr. Stephen subsequently, I suppose, received \$340; or, taking the price established at the original grant, \$3.00 per horse-power, would be \$150.00 deducted from \$340.00, leaves \$190.00 rent for mill site and profit upon water-power, if the above rate had been paid. Mr. Stephen received, until the rent was increased to its maximum,

\$135.00, the water for the woollen mill for nothing, and the bonus of \$150.00 per annum which should have been received for water sub-leased by Mr. Mattico. Since the erection of a woollen mill, a cotton mill has been built driven partly by water, steam being used for the balance of the power required.

This privilege is using, according to the discharge of the wheels, 675 horse-power, or 475 horse power, for which no rent is received, these powers having been transferred to manufacturing companies, presumably, at a profit to the lessee, made at the expense of the country. For the interest upon the cost of the supply weir, \$600 per annum, to which is to be added the large expenditure necessary to bring the water to the head of this race-way, there is little return.

The Stormont Cotton Company have lately increased the size of their mill, and will have in operation over double the number of spindles than before the addition. They have gone to a large expense in putting in turbines manufactured in the United States, of a high reputation for efficiency. By draught tubes they have taken advantage of the full head during the season of navigation, thus economizing the water, an example to other lessees upon the canals which the Department might insist should be followed.

From the size of these wheels and the enormous power they would give under summer head, or even the winter head, it might be supposed this mill would consume a large amount of water. This number of wheels has been put in, to enable the machinery to be driven during back-water, or when there would be, say, a 10 feet head, the four wheels would furnish power, if there is sufficient water in the canal, to drive the machinery. The amount of power, required for the machinery in the mill, depends upon the class of cotton manufactured, average number of yarn, and the description of machinery. When it is in full operation this can be determined; I should judge it to be 550 to 600 horse-power,—they have leased 90 horse-power.

The estate of Andrew Hodge, or Hodge & Brothers inform the Department that they are about changing their mill, putting in new machinery and a better class of water wheels. Their present wheels discharge water sufficient for about 230 horse-power; they have leased 80 horse-power.

The only wheels upon this level, that cannot be considered economical in the use of water, are those in the mills of Hodge & Brothers and of William Mack, a sub-lessee of George Stephen. By the terms of his lease and that of Lawrence Ballard, they have power computed at 65 per cent. for useful effect, and at a head of 8 feet and 10 feet respectively. The Cornwall Manufacturing Company have also a head of only 13 feet upon their wheel. In these cases, the Lessee from the Government should be required to lower the wheels and tail-races, in order to economise the water, as the same power could be obtained by this means with less consumption of water.

Some action to economize the water will soon be necessary. In a previous report, the evidence is given of a number of captains navigating the canal, which shows that too much water is being drawn for mill purposes. The Stormont Cotton Company, since the date of that report, have put in better wheels and are taking advantage of the full summer head. Although having double the number of spindles in operation than they had at the date of that report, by the use of a better class of turbines and greater head, they will draw little more water during the season of navigation.

Besides the fall between the level of the Cornwall reach and the river, there is water-power available at three locks, with a head or fall of 8 feet each. It is obvious, there is the same quantity of water to be utilized for power at these locks, as the Government permits to be discharged into the river by the mills upon the Cornwall level.

The power at Lock No. 18 has been granted to a company for the manufacture of paper, for which an extensive building is being erected. The wheels used will give some 400 horse-power or at the rate rented, some 30 cents per horse-power—this amount of power may not be required at present. In 1872, W. Hospelier applied for power at Lock No. 19, for the manufacture of paper. An Order in Council granted him 150

horse-power free of rent while buildings, &c., were being erected, and \$3.00 per horse-power afterwards, but for some reason no lease was executed.

The power at Lock No. 20 has been leased, but was recently cancelled, the lessee holding it for merely speculative purposes. At this lock an expensive supply weir was constructed for hydraulic power. At both locks Nos. 19 and 20, there is valuable water-power ready to be leased,—400 horse-power if the late lease to the paper company be taken as a basis, or some 550 horse-power if the water drawn from the Cornwall level be taken, at each lock. The power at these locks is of more value than upon the Cornwall level, the head being invariable and not subject to back water.

During the winter the river opposite Cornwall is subject to ice-jams, which dam back the water in the river, to the extent that for short periods, there is little fall between the river and the Cornwall reach. The least average head for one month was in February, 1880, 6ft. 7in., and for the three months of that year, January, February and March, the average head was only 8ft. 8in. The average head, according to the table appended, during twenty-two winter seasons, is say 16 feet. This power is similar to that furnished between Basin No. 2, Lachine Canal, and the River St. Lawrence, Montreal, where they are subject to back water in a similar manner. The average, for twenty-two seasons of navigation, would give a head of 22 feet.

The power upon this canal should be worth \$10.50 per horse-power per annum. Taking the discharge of the wheels there will be used some 1,800 horse-power, yielding a rent of \$765.00 per annum, which if charged at the rates stated would give \$18,900 per annum, with an additional revenue for the water at the locks not leased of \$8,400, or a total of \$27,300.

Upon this canal we have the history of the Lachine Canal repeating itself. The mills are using a very large quantity of water, in excess of what was originally leased to them by the Government. The supply weir at the head was of sufficient capacity to discharge this quantity. In 1857, the Chief Engineer of Public Works recommended that the supply weir, and race-way, at the head of the canal should be enlarged, and he then deemed it inadvisable to lease any more power upon any level. In a subsequent Report he states:—

“I may further add that a full and close examination of the upper inlet of the canal, during the past summer, places beyond a doubt the correctness of the opinion given in the report (No. 32,082 above alluded to), that is to say, no more water-power can, under any circumstances, be granted on the level opposite Cornwall, without causing certain and permanent injury to the navigation, to an extent that nothing, in my opinion, could justify.”

Since the date of these Reports, there has been no additional power leased—except recently, which is not yet in use—nor has there any more been paid for, though the consumption of water, as before stated, is very much greater than at that date.

The supply weir is sufficient, at stages of low water, for all the purposes of navigation, even for the enlarged canal. When the head between the river and canal becomes less than 1 ft. 6 in. there will be great difficulty in maintaining the navigation level of the upper reach, and supplying the water now used by the mills.

Any expenditure that may be made, to increase the area of supply, will, therefore, be made purely for the benefit of the mills. If they are restricted to the amount of power originally leased, 370 horse-power, the weir is sufficiently large as at present.

The supply at the head was least in 1872, the average level of water in the river during the season of navigation was 9 ft. 3 in. above the metre sill, guard lock. During the winter season of 1871-72, the average level was 8 ft. 1 in. For the four months, May, June, July and August, the average head was only some five inches, that is, the river was at a level, that the head was too great to open the guard gate with safety, to increase the supply, and not sufficient to discharge the quantity of water used by the mills. In September and following months the water was low enough to open the gates. During the four months the supply would be only suffi-

cient to furnish one-fourth the quantity of water now used. During seven seasons, out of twenty-two of navigation, the head was less than that requisite to discharge this quantity. At the next season of low water the navigation interest will commence to complain, without lessees are restricted in the quantity of water they are using. Upon the lower level this could be easily done, as there is leased only 370 horse-power.

The amount of water, for milling purposes, has been increased by a late Order in Council, by which, for a nominal rent, 400 horse-power has been granted at lock No. 18. The supply necessary to furnish the power leased on the Cornwall level, if the Government insist upon full head and good wheels, would be some 200 cubic feet per second, which lessees could be restricted to. By this lease of 400 horse-power, on an eight feet head, the leased water, for mill purposes, has been increased to nearly 600 cubic feet per second, which cannot be supplied without a foot head between the river and canal. There was not this head, in the months of September, October and November, during a number of years. From the table appended, it will be seen, the supply must be short during winter seasons. The power leased is not guaranteed, it is a variable power at nominal rent; on this basis the amount of supply at the head is sufficient. What power has been obtained has been created at a great expense, while little return has been made for this expenditure; therefore, the Government should not be called upon to expend money to make the supply more constant. In the administration of this canal, when the head fell below 1 foot 6 inches, the mills should have a proportion of the water used by them shut off, and the supply at all times in seasons of low water not allowed to interfere with navigation; under these conditions there would be a power of much greater value than is now paid for it.

A question of the same character arises as in the expenditure for the supply of the Lachine Canal. It would seem an injustice that the people should be taxed to contribute to the wealth of these manufacturing corporations.

There are six sluice-ways for supply; two of these are more than sufficient for the wants of navigation, the other four are for the mills. Now, to what extent will this continue? Will the area of supply be increased, in order, that a one foot head, a six inch head, or a three inch head, be the limit taken, to discharge the water, used by the mills, into the canal? The less the head taken, as a standard, the greater the cost of supply, and the greater the value of the power.

By the Order in Council the Toronto Paper Company are granted 400 cubic feet per second more, for mill purposes, than was granted by former leases, which represent at their rates, a rental of \$80 per annum, at 10 per cent. capitalized, \$800. This sum would be a small contribution for the construction of a raceway to supply 400 cubic feet per second at low water.

VALUE OF POWER IN THE MANUFACTURE OF PAPER.

In the first report, of this series, I alluded in a general manner to the cost of power in the manufacture of cotton. As there are several paper mills upon the canals, and as this is the latest lease of water for a paper mill, some statements will be made with reference to this concession.

The Toronto Paper Company are to manufacture fine writing papers. Holyoke, Mass., is the chief seat of the manufacture, of this class of paper, in the United States; 150 tons per diem, principally of the fine grades, are manufactured.

Mr. Emerson, a practical hydraulician, who has had a long experience at Holyoke, states with reference to the power at that place:

"The haste for large immediate dividends has harnessed the noble river to a business insatiate in its demands for more; the paper manufacturer that has all the power he wants is a phenomenon. Except the hebdomadal stop, more for repairs than prayers, the draught from the pond is unceasing. The water-power sufficient to give employment to a thousand hands, in the manufacture of paper, will be abundant for the employment of six thousand, in the manufacture of cotton goods."

Four paper mills are now in operation, the Toronto Paper Company will make the fifth, upon the Canadian Canals, they will consume a large quantity of water, and pay little rent. With reference to this late grant, the mill is not yet in operation. The present tariff, for the class of paper they will manufacture, gives a protection against the Holyoke manufacturer of 22½ per cent., *ad valorem*, on calendered paper, and 25 per cent. on ruled paper and envelopes,—the latter will, probably, be the chief product of the mill. This 25 per cent. was, presumably, considered sufficiently high to encourage the manufacturing of this class of paper, in the Dominion, and enable it to compete with that manufactured at Holyoke and elsewhere. If this be the case, and the tariff enables this Company to dispose of their paper at a fair profit, a proportion of the difference, between the price paid for power here, and at Holyoke, becomes a bonus to a paper manufactory, not hitherto considered, or an annual transfer of the taxes of the community who provided the water power and maintains it, into the hands of an individual or a company.

In order to determine the cost of power, to a paper manufacturer at Holyoke, I wrote to the Hydraulic Engineer of that Water-Power Company, Clements Herschel, Esq., for information as to the cost of power, both for newspaper and fine paper mills, his replies contain the following:—

"None of our mills make the class of paper to which you refer, 'news.' Our water rates are, however, irrespective of articles manufactured. We have two kinds of power, permanent and surplus. Permanent is warranted for every day of the year. Surplus may be withdrawn in a moment's notice. Parties drawing after such notice must pay a heavy penalty. Permanent power has varied greatly in value since Holyoke was started. It is sold with land usually, hence its precise value can hardly be stated. I should say it was worth, to-day, a rental of \$1,200 per annum, for sixteen hours power; \$2,400 per annum for twenty-four hours power, per mill power.

"Surplus rates have been fixed at \$5.00 per day, of twenty-four hours, per mill power, for six years, from 1st January, 1882, when used to an extent not in excess of 50 per cent. of amount of permanent power owned by the party using the surplus. Beyond such 50 per cent., the rate is doubled.

"Most of our mills pay a rental of about \$450 per annum, per mill power, twenty-four hours power. This is irrespective of cash paid at time of purchase."

The term mill power has been explained in a previous report; it nets from 60 to 65 horse-power.

From these facts, a paper mill in Holyoke, manufacturing writing paper, pays the Water-Power Company, exclusive of the original cost of the power, which Mr. Herschel states varied, \$7.50 per horse-power per annum, or, a mill using 400 horse-power would pay annually \$3,000 for what the Toronto Paper Company will pay \$120 per annum. To make a fair comparison, the interest upon the capital expended, in the original purchase of the power, at Holyoke, should be added, this \$7.50 being the amount paid to the Company for the maintenance of the power without reference to its original value. For every horse-power of surplus water used, the Holyoke manufacturer pays \$23.00 per annum, against 30 cents paid by the Toronto Manufacturing Company. Or, taking the value of power at Holyoke, at the present time, which has lately been determined by sale, 400 horse-power in the manufacture of paper would cost \$16,000, in contradistinction to \$120 in Canada. To avoid misconception as to the rates—paper manufacturers are charged higher for power, on account of drawing water the whole twenty-four hours.

If a tariff of 25 per cent. is sufficient for a legitimate profit, what must this cheap power be called?

The paper manufacturers on the other canals, are A. Buntin & Co., Beauharnois, who pay, in round numbers, \$1.50 per horse-power—the cost of this power to the country is stated in a report upon that canal.

John Riordon pays 50 cents per horse-power or a protection in his favor, against A. Bunting & Co., of \$1 per horse-power, or if the latter are required to pay for surplus water used, a protection to the former of nearly \$4.50 per horse-power. The

Lincoln Paper Mills have not as yet paid anything, but, according to agreement, some 70 cents per horse-power. The St. Catharines Water Power Co. have a lessee manufacturing paper; the amount paid by him I am not aware of, but he no doubt pays higher for his power than the lessees direct from the Government, consequently he is weighted in his competition with them.

With regard to Messrs. Bunting and Riordon, respectively, these low prices for power include land for mill sites, which is not included in the value of power at Holyoke.

The tariff is 20 per cent., for news, and the class of paper they manufacture, which may not be more than sufficient for the protection of the man who has to purchase a water power, build dams, and incur all the attendant expenses of utilizing it; to these Government lessees, this cheap power represents an annual bonus of \$14,000 per annum.

Profits, thus attained represent, neither mental nor physical labor, nor a return for capital expended.

If there was a fair division, if the work people who toil amidst the rags and chemicals of a paper factory, and by whose labors fortunes are made, received their share of the profit; or if it was returned indirectly to the people, it would not appear so unjust. On the contrary, it becomes capital unearned, the result of no labor, except of those who are taxed for its contribution. The aggregation of capital, which grows upon itself, in the hands of the few, at the expense, and labor, of the many, is an evil which should be prevented, when possible, by the State.

CORNWALL CANAL.

TABLE of Average Levels of Water during Season of Navigation and the Winter Season, of the River St. Lawrence at Lock No. 15, and Guard Lock—Lock 21; also of Head and Fall between River and Canal at these places.

YEAR.	LOCK NO. 15.						GUARD LOCK.					
	Winter Season Average of 121 days from 16th December to 16th April.			Season of Navigation Average of 244 days from 16th April to 16th December.			Winter Season Average of 121 days.			Season of Navigation Average of 224 days.		
	Level of Water Cornwall Level above Mitre Sill.	Average level of Water on the lower Mitre sill.	Head or Fall be- tween Cornwall Level and River	Level of Water Cornwall Level.	Average level of Water on the lower Mitre Sill.	Head or Fall be- tween Cornwall Level and River	Level of Water in Canal.	Average level of Water in River above Mitre Sill.	Head or Fall be- tween River and Canal.	Level of Water in Canal.	Average level of Water in River.	Head or Fall be- tween River and Canal.
	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft.	Ft. In.	Ft. In.	Ft.	Ft. In.	Ft. In.
1860-61.....	33 0	21 0	12 0	33 0	11 1	21 11	9	10 6	1 6	9	10 11	1 11
1861-62.....	33 0	18 3	14 9	33 0	11 10	21 2	9	10 9	1 9	9	11 10	2 10
1862-63.....	33 0	15 9	17 3	33 0	11 5	21 7	9	10 6	1 6	9	11 7	2 7
1863-64.....	33 0	17 3	15 9	33 0	11 2	21 10	9	9 4	0 4	9	11 1	2 1
1864-65.....	33 0	17 1	15 11	33 0	11 3	21 9	9	10 3	1 3	9	11 1	2 1
1865-66.....	33 0	18 0	15 0	33 0	10 8	22 4	9	8 9	0 0	9	10 7	1 7
1866-67.....	33 0	18 11	14 1	33 0	10 10	22 2	9	10 8	1 8	9	10 6	1 6
1867-68.....	33 0	19 9	13 3	33 0	11 1	21 11	9	9 0	0 0	9	10 11	1 11
1868-69.....	33 0	15 7	17 5	33 0	10 4	22 8	9	9 1	0 1	9	9 10	0 10
1869-70.....	33 0	19 2	13 10	33 0	11 2	21 10	9	11 0	2 0	9	11 0	2 0
1870-71.....	33 0	17 8	15 4	33 0	11 6	21 6	9	10 1	1 1	9	11 9	2 9
1871-72.....	33 0	18 2	14 10	33 0	10 6	22 6	9	8 1	0 0	9	10 5	1 5
1872-73.....	33 0	15 1	17 11	33 0	9 7	23 5	9	9 2	0 2	9	9 3	0 3
1873-74.....	33 0	16 5	16 7	33 0	10 7	22 5	9	10 7	1 7	9	10 6	1 6
1874-75.....	33 0	18 10	14 2	33 0	10 9	22 3	9	8 5	0 0	9	10 8	1 8
1875-76.....	33 0	17 8	15 4	33 0	10 0	23 0	9	9 11	0 11	9	9 8	0 8
1876-77.....	33 0	19 4	13 8	33 0	11 6	21 6	9	10 2	1 2	9	11 6	2 6
1877-78.....	33 0	12 6	20 6	33 0	10 3	22 9	9	9 9	0 9	9	10 1	1 1
1878-79.....	33 0	17 9	15 3	33 0	11 0	22 0	9	10 1	1 1	9	10 10	1 10
1879-80.....	33 0	13 11	19 1	33 0	10 4	22 8	9	9 8	0 8	9	10 9	1 9
1880-81.....	33 0	15 2	17 10	33 0	10 2	22 10	9	8 7	0 0	9	10 1	1 1
1881-82.....	33 0	13 4	19 8	33 0	9 11	23 1	9	9 11	0 11	9	9 9	0 9
Average.....	33 0	17 2	15 10	33 0	10 9	22 3	9	9 9	0 9	9	10 8	1 8

CORNWALL

Table of Water-Wheels, Approximate Discharge of Water and Number of

Name of Lessee.	Name of Occupant.	Situation of Mill.	Date of Lease.	Term of Lease.
George Stephen.....	Canada Cotton Manufacturing Co.	North of Locks, Nos. 15, 16 and 17.	Aug. 9, 1867	21 years, from Jan. 1, 1867
do	Lawrence Ballard.....	.....	.....	.....
do	Cornwall Manufacturing Co.	.....	.....	.....
do	William Mack .....	.....	.....	.....
do	do .....	.....	.....	.....
do	do .....	.....	.....	.....
do	do .....	.....	.....	.....
Andrew Hodge.....	D. A. Hodge & Bros.	South side of Cornwall Level.	April 19, 1879	21 years, from July 1, 1871
do	do .....	.....	.....	.....
do	do .....	.....	.....	.....
A. F. Gault	Stormont Cotton Manufacturing Co.	South side of Cornwall Level.	May 2, 1879, June 9, 1879	21 years, from Jan. 1, 1870, July 1, 1871.
Toronto Paper Co....	Toronto Paper Co....	North of Lock No. 18	.....	.....
do	do .....	.....	.....	.....

CORNWALL

Number of

CANAL.

Horse-powers Used, and Machinery in the Mills of Hydraulic Lessees.

Lense.

Jan 1, 1867

July 1, 1871

Jan. 1, 1870,

Description of Mill.	No. of Runs of Stones Leased.	Yearly Rental.	Character and amount of Machinery in Mills.	Number of Hands Employed.	Description of Water-wheels in Use.			Head, Water Discharged, Power Used and Leased.			
					Maker and Class.	Name.	Number. Size or Diameter in Inches.	Head acting on Wheels in Feet.	Cub. Ft. Water discharged per Sec.	Horse-power at 75 p.c. for useful effect.	H. P. leased at 75 p.c. for useful effect
Cotton Mill.	20	\$ cts. 135 00	40,000 spindles, 1,000 looms.	1,200	.....	Leffel....	2 50	22	228	425	
Pottery .....			.....	11	Wilson & Co..	Little Giant.	1 21	10	19	16	
Woollen Mill			8 sets manufacturing cards.	220	.....	Leffel....	1 74	13	153	169	
Flour Mill ...			5 runs and machinery.	5	In wooden scroll.	Tyler ...	1 54	8	30		
do					do	do ...	1 48	8	30		
do						Leffel....	1 35	8	22		
do					Wooden bucket.	Central disch'ge	1 30	8	14	65	
										675	200
Woollen Mill	8	240 00	3 sets of cards ...	.....	Wilson & Co...	Little Giant.	1 21	17	25	.....	
Planing Mill			Planing machine .....	.....	In wooden scroll.	Tyler ...	1 35	15	19		
Flour Mill			6 runs and machinery.	25	Wooden bucket.	Central disch'ge	6 48	15	135	230	†80
Cotton Mill.	9	270 00	23,840 spindles, 540 looms.	550	Holyoke Manufacturing Co	Hercules	4 56	22	234	550	†90
Paper Mill...	*	120 00	6 engines—3 beaters.	150	Stout Mills and Temple.	New American.	3 66	8			
do			3 washers—1 Jordan.	.....	Dayton, O .....	.....	1 48	8	604	410	400
		765 00	.....	2,161	.....	.....	24	.....	.....	1,865	770

* 400 horse-power.

† Mill said to be about being changed and better machinery placed in it.

‡ See Report.

WILLIAMSBURGII CANALS.

The Williamsburg Canals are a series of three, Farran's Point, Rapide Plat, and Galops Canals; they render navigable 27 miles of the River St. Lawrence, and have a combined length of some 12 miles. The rapids which these canals are constructed to overcome, have not a declivity sufficient to prevent steamers of a certain class and power ascending. The water prism of this series is smaller than the other unenlarged canals. For these and other reasons; there is much less power, in comparison with a similar head, or fall, than upon the Beauharnois and Cornwall Canals.

The Farran's Point Canal is 5 miles from the head of the Cornwall Canal and 81 miles from Montreal, by rail. Its length is three quarters of a mile, with one lock of 4 foot rise of lockage.

The Rapide Plat Canal is $10\frac{1}{2}$ miles above Farran's Point, and 92 miles, by rail, from Montreal. Its length is some 4 miles, with one lift and one guard lock. The rise of lockage is $10\frac{1}{2}$ feet.

The Galops Canal is $4\frac{1}{2}$ miles above the Rapide Plat, and $7\frac{1}{2}$ miles in length, with 2 lift locks and 1 guard lock, and a total rise of lockage of $15\frac{3}{4}$ feet.

Iroquois, and Point Cardinal, where the mills are situated, are 99 and 104 miles, respectively, from Montreal by rail.

Farran's Point Canal.

The water-power upon this canal has not the same importance as those upon the other canals, the head or fall being some four feet, although more power could be obtained by increasing the area of the supply race.

In 1847, Mr. Mills, engineer on the construction of this series of canals, in reply to a letter of the Secretary of the Department, states that three runs of stones could be leased upon this canal.

In the list of hydraulic privileges on the St. Lawrence canals, proposed to be leased, dated December, 1850, it is stated:

"A lot at the foot of the canal, containing about half an acre, with water sufficient to propel four runs of stones, constant supply summer and winter. Head and fall four feet."

On the 10th February, 1848, this lot, at an upset rental of £50, was put up to auction. There were no bids at the price. At a second auction, 12th February, 1849, there were no bidders. In 1851, and subsequently, there were a number of offers from responsible parties for this privilege, at a rental of £40 per annum, or \$4.00 per horse-power. Owing to claims which were still in abeyance, made by the owners of the land taken for the canal, for the damage to a mill site, this privilege was not leased at that time.

The arbitrators on land damages made an award of £650 for injury to a mill privilege, and £1,250 5s. for land, &c.

A Mr. Freeland, Government agent or arbitrator, to settle claims upon these canals, reported the award of £650 was excessive, and that it should be appealed against. He states:

"I do not know any other ground of appeal than the extravagant amount of the award, particularly £650 for a supposed mill privilege, when no attempt has been made, or one shilling expended, with a view to a mill or any such thing."

The Attorney-General (West) Hon. W. H. Draper, was asked for an opinion on the advisability of appealing against the award. He reported that application should be made to the Court of Queen's Bench. It appears, according to his opinion,

that the claim or damages was "rather the opportunity to create a mill seat, than a mill seat to be taken away." He states:

"It appears to me, the application should be made, in order to determine judicially, whether damage ought to be awarded to the owner of land bounded by a navigable river, founded on a calculation of what the land taken from him would be worth if he had dug a raceway through the land, and then applied to his own use a portion of the water of the river; in other words, the power of drawing off a portion of the river, and applying it to his own uses, which power has not been exercised, form an element of the land taken, proper to be estimated by the arbitrators, particularly if, in order to use the water, any erection or other work without the limit of the party's land is necessary."

An application was made to the Court of Queen's Bench to set aside the award. On the 10th September, 1846, the law agents inform the Department that, "The rule has been discharged, not because the award can be sustained, but because the Act passed last Session to amend the law constituting the Board of Works deprived the Court of Queen's Bench of the power which it previously had in such cases; the Court, however, stated that if they had the power they would have set aside the award on several grounds. The award of course can never be acted upon therefore, and Mr. Farran can reap no benefit from the same."

On the 19th July, 1849, the Solicitor-General, the Hon. W. H. Blake, reported upon this case. He stated that the repeal of the Act under which the arbitrator's sat, after the award had been made, should not be allowed to affect Farran's rights. He was of opinion that the portion of the award respecting which no legal objection exists, £1,250, should be paid with interest from the time of the award, leaving Mr. Farran to make a further application for the balance, £650 (the legality of which is doubted by the present arbitrators), if he should be so advised."

This matter remained unsettled until the 14th May, 1858, when an Order in Council was passed, authorizing the Department to settle with Mr. Farran, by making over the privilege to him, on condition that he gives a receipt for all claims he may have under the award or otherwise. Mr. Farran accepted the propositions of the Government, a draft deed was drawn up, of which I can discover no record in the Department, or whether it was executed does not appear.

The value of this grant, according to the offer made for the privilege, would equal the original award of the arbitrators, which would appear to have been large for only prospective damages, and to which there would seem some doubts of a legal claim. It is evident that, for any surplus water above the four runs of stones used, the Government could demand rent, and that the occupant has no right to any larger power, if such could be utilized, than 40 horse-power. Besides the four runs in the mill, he has a carding mill and shingle machine in operation, for which the Department could demand rent.

It would seem, considering the large number of applications for this privilege, that if it had been offered at auction, to the highest bidder, and the claims settled by a money payment, it would have been preferable to the perpetual surrender of Government land and water, as has been done in two other instances upon the canals.

Rapide Plat Canal.

Upon this canal, at Lock No. 23, the power is obtained by the fall between the river and canal, which varies according to the height of the river, the lift is stated at 11 feet 6 inches. At the lock named, a mill site was laid off, with six runs of stones attached. It was put up to auction, in February, 1848, at an upset price of £100, and taken at that price by James Holden, but no lease seems to have been executed. It was again put up to auction at a lower upset price, I presume, in February, 1849, and sold to Mr. Benjamin Chaffey, for £61 10s., with whom a lease was executed on 12th February, 1852, dating from 1st July, 1849. Two-thirds of this site were assigned to W. Gibson, on the 31st August, 1867,—the other third is now

occupied by Mr. McKenzie. The whole power is now said to be under the control of Mr. Gibson.

There should not have been leased any water, for mill purposes, upon this canal, as there is no supply weir at the head. The feed of the canal, ^{Insufficient area of supply at the head of canal.} for both navigation and mill purposes, has to be supplied through the valves in the gates of the guard lock. This instance supports the assertion, frequently made, that all this mill water is supplied by expenditure for that purpose; here we have a canal, certainly, of inconsiderable length, but still, for thirty years, operated with only the valves, in the gates, to furnish water for navigation and for the mill leased. This has been done very ineffectually, and to the great inconvenience of navigation. When the head between the river and canal is too great to open the gates, or about six inches, the level of the canal has been run down one foot and a half, when locking was taking place simultaneously at Lock No. 23 and the guard lock. The supply being closed at the head, drawing water for the mills, together with that required for lockages, must certainly run down the reach.

The level of the water in river, or on mitre sill of guard lock, is frequently very low during the season of navigation. In October, 1872, the average level was 7 feet 9 inches; in October, 1877, the average was 7 feet 10 inches; in October, 1881, 8 feet 4 inches. In winter, the average for February, 1873, was 6 feet 7 inches. There would be great inconvenience experienced by vessels, on these canals, if they were required to use them on the downward trip. They descend by the rapids; on the upward trip, the return cargoes being lighter, and as they load only to the depth they can pass through with, that is, according to the height of water in river, on the different mitre sills of this series of canals.

There have been surveys made for a supply weir, and an appropriation placed in the estimates, for that purpose. When constructed it will be for the benefit of the mills; if the large supply necessary for them could be drawn through the valves for thirty years past, they would be sufficient for navigation which requires a small quantity, at least, until the ^{Appropriation for an increased supply.} canal is enlarged.

The hydraulic Lessee complains of the inadequacy of the supply, and the frequent stoppages that have to be made upon that account, and states correctly that either the mill privilege should not have been leased, or a supply weir should have been constructed. The sum of \$40,000 has been voted for this purpose. By closing the supply of water to the mills, certainly if for the length of time stated, both navigation and the mills have been supplied, even if inadequately, the means of supply is sufficient for the present scale of navigation, and \$10,000 would supply all the water required for an enlarged navigation, which would leave \$30,000 chargeable to mills, or, \$3,000 per annum; the present rental is \$246.00 per annum.

The Lessee upon this privilege has leased 70 cubic feet per second, if there is used all the wheels can discharge, it would be five times the amount. These facts have to be taken into consideration, as this expenditure, as well as similar expenditures upon the canals, will be ascribed to the necessities of navigation, those necessities being caused by the water drawn from the canals for mill purposes.

Probably, with the improvements necessary for the more constant supply of water upon the present canal, 600 horse-power could be leased, which, at \$10.00, would return \$6,000 per annum. The original upset price for power here, was nearly \$7.00 per horse power, it was subsequently sold for \$4.00 per horse-power; after 30 years its value should be at least that stated, \$10.00 per horse-power.

Galops Canal.

At Lock No. 25, Iroquois, there is power obtained by the head, or fall, between ^{Power on the Iroquois section.} the river and the level of canal, some 8 feet, which varies according to the height of river.

At this place, a mill site was located with four runs of stones attached. At the first auction, it received no bidders at £75, upset price. At the second auction, in

February, 1849, it was sold to Mr. William Elliott for £35. This property passed into the hands of other parties. The mill has recently been burnt down, and in its reconstruction the Department is in a position to insist upon the most improved class of water wheels being used. Two other mill privileges of four runs of stones each, were subsequently leased at this place. There is, on one of the sites, a country saw mill, with water wheels of the most primitive and inferior class, such as should not in any way be permitted upon canals, where the cost of bringing water to the mills has been so heavy. On the other site, is a mill with the same description of water wheels, water being wasted in propelling wood-working machinery requiring but little power. The latter property was leased to Philip Carman, and subsequently transferred. The following extract from a letter from the Collector of Canal Tolls, November 26th, 1877, will explain the position of affairs:—

"During the time George Stephen used the power at Iroquois, I wrote him requesting payment of rent, when due, and not getting answer to any of my letters, I went to Montreal, but did not succeed in collecting his rent. I explained the matter to Inspector Bell, who also called on Stephen for payment of amount due by him.

"Stephen sold the property to Clayes & Smith, who had possession of it for two or three years. They did not use the water-power and would not pay rent. Clayes & Smith sold the same property to P. O'Keefe, who has used the water-power since he got possession of the property, and, although I have made many calls upon him for rent due since he had possession, I have not been able to collect it."

This is an example of the transference of Government property from one party to another, with long standing arrears of rent against it, in this case 14 years, with a balance of rent due of \$2,100.00; passing through the hands of wealthy people who refuse to pay rent, and eventually into the hands of poor men, from whom the Government will probably not be able to collect.

The present occupant requires little power. He considers he is paying too high a rent, and that it should be reduced. Not having the capital to improve the property, or place in it better machinery, the rent is no doubt high for the amount of power he obtains. A property, consisting of building, poor and broken down wheels, flume, and Government lease, is considered as a whole, and in its dilapidated condition proves a poor investment, which he wishes to improve by refusing to pay arrears and having the rent reduced. These cases, of which there are many upon the canals, show the importance of the recommendation made previously, that no lessee be allowed, or that he be rendered unable, to execute a legal transfer of a Government lease without consent from the Department, and until all rents due are paid. A man may buy a property with a large claim against it, of which he may have imperfect knowledge, this claim caused by the collection of rent not having been enforced from wealthier people who have held the lease previously.

Carman & Company, occupying the next privilege, are in arrears. Mr. Witton, Inspector of Canal Tolls, makes the following remarks as to lessees in this locality:—

"The large arrears on the Starch property are known to the other lessees, and this has demoralised them. I question if any arrears can be collected here without making arrangements to stop the supply of water, or unless some such means be taken."

LOCK NO. 26,—POINT CARDINAL.

At this place there is a mill site and water for eight run of stones, deeded in fee simple, as compensation for damages. With reference to this grant

History of a grant, in perpetuity, of a mill site and water power.

there has been considerable trouble and long standing claims; the first correspondence commences in 1843, the last is in 1882.

At the date of the construction of the Galops Canal, there were the ruins of a mill, and a crib work pier, extending parallel to the current of the river, by which a low head was obtained, and a power created of small extent and little value.

This ruin, and the adjacent land, was owned by J. Jessop. When the surveys of the canal were completed in 1843, he writes to the President of the Board of Works,

asking, whether he would be inclined to negotiate for the use of the water, from the canal, for a mill, in lieu of damages which his mill property would sustain by the construction of the canal.

The following remarks were made by Mr. Freeland, Government Arbitrator, as to this claim:—

"On the 15th October, 1796, Charles Doyle, for the consideration of £20, grants to Hugh Munro that piece of land now encumbered by the mill now standing on Point Cardinal, with the water fall and any other appurtenances and privileges thereto belonging. On the 1st April, 1835, Munro conveys to Casselman on the same terms, and on the 17th June, 1843, Casselman to Jessop, likewise."

He then enters into titles, and states: "Such being the case, I think that Mr. Jessop's claim to the land is not only vitiated, but his mill privilege is set aside in a great measure. The mill building is at the foot of the rapids; the fall is all above, on Seers' ground. Mr. Jessop rests his claim, I think, chiefly on possession of this said strip of land; the only possession that appears, is an attempt to make a mill-race which was abandoned, the ground never was enclosed, but grazed and used by Seers the same as the rest of his farm.

In 1844 Mr. Jessop petitioned His Excellency respecting a mill site. It was referred to the Board of Works, and forwarded to the Engineer of the Canal for report.

The President of the Board of Works, Hon. H. H. Killaly, reports to the Provincial Secretary: "From the report (the Engineer's) and from Mr. Draper's opinion, it appears that the original mill only existed by sufferance; it further appears, from the report of the Engineer, that when the canal was contemplated the re-erection of the mill became a matter of speculation; but under all the circumstances I do not see that Mr. Jessop has any claim either to the mill site or for compensation for the preparation which he says he has made for the building of the mill, inasmuch as prior to the preparation being made, permission for its construction was refused by the Commissioners. When the works are sufficiently advanced, a mill site of much greater value will be created near the lock in the vicinity of the old mill, and the intention of the Department is, with the approbation of His Excellency, to advertise and let this mill site to the highest and best bidder.

Mr. Mills', the Engineer's, report referred to above, states with reference to the mill: "The fall here is a little less than 2½ feet. A wooden mill, at this point, was built by a Mr. Munro about fifty years since, it had one run of stones, and did a fair business. Munro became involved and sold to Martin Casselman. Said mill was a ruin in the spring of 1833, and must have been so for some years previous to that date. It is believed by some it was burnt designedly by the boatmen, who treated it as a nuisance. In the spring of 1836, said Casselman proposed to rebuild the mill, which was subsequent to the Act authorizing the improvement of the St. Lawrence, and applied to the Governor General for that purpose. The application was sent to me at Cornwall by the Commissioners for the improvement of the St. Lawrence, asking for my report upon that application. That report, *refusing permission*, is in the report of said Commissioners made in November, 1836. However, our surveys, in the spring of 1843, found a stone mill commenced. * * * There have been no expenditures upon the mill-race since the mill became a ruin, and I am not informed as to the other preparations referred to. I cannot see that the present owner, Mr. Jessop, has any claims to preference as to the power to be disposed of ultimately."

Another petition to His Excellency was sent by Mr. Jessop in January, 1845. A report to Council was made on the 7th March, 1845, stating that Mr. Jessop had set forth his case more fully, and Mr. Draper was of opinion he had a good claim. Mr. Killaly recommended that a mill site and water from the canal to propel his machinery be given him under certain conditions and in lieu of all damages. This report was approved of by Council 9th April, 1845.

Mr. Jessop assented to the proposition, but demanded the whole power at this lock. A letter is written to Mr. Jessop expressing surprise at this proposal, saying

he has been most liberally dealt with. "With reference to the exclusive privilege you now demand, so far from consenting to it, the Board must restrict the volume of water, to which they will give you a right, to a quantity not exceeding that sufficient to work four runs of stones."

The Attorney-General, West, reports in August, 1845, that it is a matter for the Board to consider, whether they had not better arbitrate on Mr. Jessop's whole claims at once, than give him a mill site and have afterwards to go to arbitration. "Should an arbitration be resolved on, I think it should be on the whole question of right from the beginning."

On the 23rd August, 1845, the Board of Works withdraw their offer and leave the matter to be decided in the usual manner. The Board informs him that in the proposal they were desirous of saving difficulty, if an equitable settlement could have been effected without too closely scrutinizing any question of strict legal right. In answer to a communication, 4th September, 1845, he is informed that all further negotiations on the matter are at an end.

On the, 4th February, 1846, H. D. Jessop, M.P.P., writes to the Hon. Mr. Daly with reference to his brother's claims. On the same date the Board of Works informs Mr. Jessop that they are disposed to accede to the offer made in his letter of the 4th September. The proposition made by Mr. Jessop, M.P.P., was that he should have a mill site with the exclusive privilege of drawing from the canal sufficient water to drive six runs of stones, any other lease to be for manufacturing purposes other than grist or flouring mills.

These protracted negotiations about a mill site, and the land damages to which I have not alluded, were ended upon the 6th January, 1847, when a grant was made of a mill site with eight runs of stones attached, the Commissioners of Public Works to construct and maintain a regulating weir over which the water must pass.

The history of this grant may be summarized: a valueless mill property at a small price is bought when the line of canal was settled upon, probably for speculative purposes; that the first report to Council refuses to recognize any claim; that the second report does, and offers power for four runs of stones and mill site; that this offer was withdrawn and negotiations stopped; that Mr. Jessop was willing to accept six runs under certain conditions; that he received for this ruin of a mill for which £20 were paid, and for alleged damages, to which there were great doubts if he had any legal right, a mill privilege and power for eight runs of stones; a year afterwards, a mill privilege was sold by auction, on the canal some distance below, which would be the value of the concession at that date, some \$328 per annum, representing a capitalized value, at 6 per cent., of nearly \$5,500.

Originally, what was known as the Galops Canal terminated at this point, subsequently it was found that the mitre-sill of the lock upon the Iroquois Canal, some miles below, had been placed too high. To raise the water in this canal it was determined to connect the two; this connection, known as the Junction Canal, was finished in 1856. On the 15th May, 1858, Mr. Jessop came forward with another petition to the Governor General, for alleged damages to his property and mill site, by the construction of this canal. He had done nothing, in the meantime, to utilize the water-power nor had any mill been erected.

He states that the mill site was beautifully situated; that the obligility, beauty, and value of the town lots were much enhanced by the river frontage; that the said Junction Canal had cut off the mill site and town from the river, and substituted the foul margin of a muddy canal for the edge of the clear water of the St. Lawrence.

A year previous to this, a Mr. Hitchcock wrote to the Department in July, 1858, requesting that an Engineer be sent to lay out a mill-race, and stated: "The privilege of building mills at Edwardsburgh I consider already disposed of by the Government to James Jessop, and by him to me."

In March, 1858, the Chief Engineer of Public Works reports against Mr. Jessop's claim, and states: "Having seen Mr. Jessop's property, both before the works were commenced and after they were completed, I am of opinion, if any such damages are done, they must be of a very limited extent."

Alleged damages
by the construc-
tion of the Junc-
tion Canal.

"As regards severance from the river, I have only to say that when the Department required the necessary lands for the canal, I was directed to consult Mr. Richards, the Attorney-General, on this point, who informed me 'that no person could sustain a claim against the Government, for any use made of the river, so long as drainage was not interrupted, nor any portion of their lands flooded.' Neither of these have been done in the case in question."

In 1858, this property came into possession of W. T. Benson, Esq. In February, 1861, Mr. Benson writes to the Commissioner of Public Works:—

"When the power, for the eight runs of stones, was conveyed to James Jessop, the Junction Canal was not made, and the head of water remained the same whether the River St. Lawrence rose or fell." He complains of being short of water during the last month,—“I beg you will look into the matter, and make arrangements to keep the head of water as high as it was when the privilege was conveyed to Mr. Jessop, as it is as much my property as a freehold estate, and can be damaged with as little impunity."

In 1858, Messrs. Benson and Aspden, after the Junction Canal had been built, and when this alleged damage to the Jessop privilege should be known, applied for a mill privilege, with power for four runs of stones at this place. This was referred to the Chief Engineer of Public Works, who reports:—

"The applicants, having purchased Jessop's rights to the water, &c., find they have, already, nearly as much power as they require; but that their land is not so suitable for their contemplated works as that portion reserved by the Government."

"But on their being informed that the land reserved was valued principally for its suitability for milling purposes, and therefore unlikely to be leased, unless at a like rate as if the power was used, they properly make the application for both lot and power, and verbally express themselves satisfied with the capacity of the head-gates."

He then reports in favor of the application, with certain conditions,—they to pay \$160.00 per annum, rental.

In May, 1860, Mr. Benson purchased from Mr. Aspden, his interest in the lease, which had been granted them; Mr. Benson then became desirous to have the lease made in his own name, accordingly another lease was so drawn up, in 1872.

In May, 1870, Walter Shanly, C. E., M. P., writes to the Department with reference to the claim of W. T. Benson, and states:—

"After carefully looking into the case, I cannot avoid coming to the conclusion that Mr. Benson has a valid claim for compensation for the diminution of head, on the eight run power bought by him, of Mr. James Jessop, and I do not think that his proposal, that, in compensation for the damage done to the Jessop privileges his lease of the Government privilege of four runs should be converted into a fee simple ownership is unreasonable or extravagant."

"If the above mode of settlement of this long pending claim should be acceded to by the Department, Mr. Benson will not then be in the enjoyment of more than an eight run privilege. Heretofore he has nominally had 12 runs, the eight purchased from Jessop, and the four leased from the Department, but the construction of the Junction Canal reduced the power by one-half."

On the 9th September, 1881, Mr. Shanly, again writing with reference to these claims, alluded to the above letter, and to some verbal settlement being made at the time. He reiterates the damage done on account of the loss of head:—

"For this diminution of power, Mr. Benson has always, and persistently, claimed compensation from the Government,—a claim that has, in effect, been recognized, in as much as payment of the rent, of the four run Government water-power, has never been exacted, though demanded every now and again in a pro forma way."

This claim has, in fact, never been recognized by the Engineers of this Department. The effect of this non-collection or refusal to pay rent, on the ground of fictitious claims, may be seen by an extract from Inspector Witton's report upon the arrears of other lessees on the Williamsburg Canals:—

"The large arrears on the Starch property are known to the other lessees, and this has demoralized them. I question if any arrears can be collected without making arrangements to stop the supply of water, or unless some such means be taken."

In his letter, Mr. Shanly also states:—

"Of the fact of the diminution of head there is no question. The level of the canal below the lock was raised, that of the river above raceway remaining unchanged. These are simple facts admitting of no dispute."

On the 21st January, 1882, Mr. Shanly writes to the Department with reference to the above letter, and Mr. Benson being notified by the Law Agents of the Government, that unless arrears were paid up proceedings would be taken against him in the Exchequer Court. He states:—Mr. Benson's individual interest in the water-power, at the Galops, has long since merged in that of the Joint Stock Corporation carrying on business under the name of "The Edwardsburg Starch Company" as President of which it is I now write. The Edwardsburg Starch Company, as Mr. Benson's assignee, absolutely deny that there is anything due to the Government for rent of water-power, but claim, on the contrary, that the Government is indebted to the Company.

The amount in arrears, upon the lease from the Government, is endeavored to be made a sett-off to the damage done the Jessop grant by the construction of the Junction Canal.

The principal point, the loss of head, of which Mr. Shanly states as a fact admitting of no dispute, will first be dealt with. Mr. Jessop, in his original claim of 1853, makes no allusion to this loss, but grounds the claim for damages upon the mill being cut off from the River St. Lawrence, viz:—"That the water privilege so granted to your petitioner was admirably situated at the foot of said canal section in direct communication with the river, and thereby with the opposite shore of the St. Lawrence, from where a good deal of custom was anticipated." The loss of head has since been added.

The levels of the water in the River St. Lawrence may be classed under two heads, normal and abnormal. Normal level, the natural flow in the river due to its hydraulic gradient, or its surface slope, and the height of water in the reservoirs by which it is fed; this depends upon the rainfall, and other climatic causes operating over the large territory whose water shed is drained by the St. Lawrence. The variations in these levels are not great.

The abnormal levels are those occasioned by long periods of heavy wind blowing up or down the river and lakes, and by the formation of ice-jams, anchor ice, &c., at various localities, which arrest the natural flow, and change the normal levels of the river. In dealing with the water-power for mills, whether practically, logically, or scientifically, we can take only the normal levels, in estimating power.

When the Galops Canal was constructed, at the outlet lock, the lift of which forms the power of this grant, there were no water registers for data, the sill was placed to give 9 feet of water at the supposed lowest stage during the season of navigation. After the construction of these two canals, the mitre sill of the lock at Iroquois was found to be set too high. The Junction Canal was constructed, which raised the water at Iroquois, some two feet, taking advantage of the difference of level of the river, between the foot of the Galops, and the head of the Iroquois Canal. It is evident that if low water in the river was nine feet on the sill of that lock, before the construction of the Junction Canal, nine feet water on the sill since its construction still remains the level of low water, and as the level of this canal is kept by the superintendent at 9 feet 6 inches during navigation, and at 8 feet 6 inches during winter, for the mutual benefit of the mills at Iroquois, and at the foot of the Galops, we find that during the winter, when the supply of water is insufficient, and full head is important, this grant has 6 inches more head at normal low water than at the date of grant.

The Commissioner of Public Works, in his report for 1849, previous to the construction of the Junction Canal, says:—

"Point Iroquois Canal.—No interruption occurred here except that occasioned by deficiency of depth towards the latter part of the season. The sill of the lock being 9 inches higher than the rest." With reference to the Galops Canal,—"The navigation of this canal was not interrupted during the past season."

Although I find no water register, of that date, at these two places, yet others on the St. Lawrence canals go to show that the river in October, 1849, was below its normal level, which proves that this mitre sill was of sufficient depth as to low water, and as the level of the canal has not been raised above low water normal level, the head could not have been affected. In fact, the mill site has been improved by giving a constant level for the tail water, and preventing back water upon the wheels during abnormally high stages of the river.

These facts are proved by impartial and competent testimony. The Chief Engineer of Public Works, who had previously been Engineer of the Junction Canal, in reporting upon Mr. Jessop's claims, before this question of loss of head had been raised, and without reference to that point, but only how far the mill site had suffered from being separated from communication with the river, states in November, 1858:—

"And so far as the claimant's mill site is concerned, it has been benefited, as a uniform head of water will now be maintained at all times by the river having been shut off, which frequently rises upwards of three feet higher than the canal surface. His land is, therefore, less flooded and the waterfall for the greater part of the year greater, so that, in this view of the case, the claimant's property has really been rendered more valuable."

This gentleman was on the ground both before and after the Junction Canal was constructed, and should, therefore, give authoritative evidence upon this point.

Mr. Baillairge, who had also been engineer upon the canal, when he laid off this property for Mr. Hitchcock, states with regard to boundaries:—"The level of the canal being lower than that of the high water of the River St. Lawrence, there remains a strip of land between the present and former water margin."

There is not the slightest doubt that no claim could be substantiated on account of loss of head by raising the level of the tail water.

Having disposed of this proposition, we will take the second of Mr. Shanly's:—
 Head proved to have been increased. "The level of the canal below the lock was raised, that of the river above raceway remaining unchanged."

Since the date of the Jessop grant, the level of the canal, or head, for this power, has been rendered more constant, and increased. First, by extension of a pier upwards, at the entrance, by which the water on the mitre sill was raised nine-tenths of a foot. Second, at the date of grant the canal was fed by the valves in the gates, some 40 square feet of area. Since that date a supply weir has been constructed, giving 98 square feet additional area of supply. The improvement of this mill site, which the Government might claim compensation for, on account of the expense of construction of the piers and supply weir, a certain portion of which could be charged to the "hydraulics," was, when the river fell to nine feet on the mitre sill, the gates would be opened and the level of the canal and river at its entrance be the same, but before the pier was constructed, at the same stage of the river above the piers, the level of canal would have been only eight feet, that is one foot head, in addition, has been given in low water to this grant since its date.

By the construction of the supply weir, the improvement since the date of grant has been practically this: as before stated, it is not judicious to open the guard gates with a greater head, than 0.25 of a foot between the river and canal, we will take 0.30 of a head before the gates are opened; when this grant was made, at any time the river was 9.30 feet upon the mitre sill, the valves in the gates would discharge into the canal 109 cubic feet per second; after the construction of the supply weir, the river at the same level, the supply would be increased to 378 cubic feet per second. In power, taking wheels, at the date of grant, giving 50 per cent. for useful effect, which would be as efficient as would have been put in; at the level of the river taken, the water discharged into the canal both for the mill, and navigation, would only equal four runs of stones, while, after the construction of the supply weir there would be water for twelve runs; instead of the assertion, that since the construction of the Junction Canal, the power, of these grants, has been decreased, it has actually been increased.

To discharge into the canal sufficient power for this grant and lease, with the valves in the gates, would require a head of 1 foot 6 inches; after the construction of

the supply weir it would not require a head of 3 inches. That is, the increased area of supply is tantamount to 1 foot 3 inches additional head before the gates are opened, and the extension of piers, nearly 1 foot, after they are opened.

The fallacy of these assertions and the claims founded upon them must be evident.

At this lock there is a head of over 6 feet and sufficient water, subject to the same variations as upon the other canals, for the power granted and leased, *i.e.* 120 horsepower, and more, during the greater part of the year. In winter, as at the Cornwall Canal, they are troubled with anchor ice, which forms in the rapids near the head of canal, together with floating ice, which the current carries into the entrance, consolidating and forming a barrier which dams off the water from the river. Mr. Benson, in his letter of 1861, states that in January there were only about 6½ feet of water in the canal, the head at the mill would be reduced; but because the water cannot be maintained at its level in the canal through obstructions in the entrance, there is no reason to suppose that the river would fall correspondingly if the Junction Canal had not been built, and thus preserve the same head. This would be inferred from correspondence on the subject.

Having proved that the tail water has not been raised in level, the claim upon this ground may be dismissed. As to the insufficient supply during a short period of the year, if this arrearage of rent was commuted upon that ground, it would affect the whole leasing of water upon the St. Lawrence Canals. This mill loses head in winter, and consequently has diminished power; the Government, in this grant or other leases, never guarantees any power or quantity of water, it is subject to navigation and the climatic effects upon the river over which they can have no control. The grant is made subject to all the conditions of the other leases which are expressed thus:—

“That in the event of the temporary stoppage of the flow or supply of surplus water, or a portion thereof hereby leased, by means of extreme high water, or by frost or ice, or any other uncontrollable cause or accident, no abatement of rent shall be claimed or allowed, nor shall the said lessee, his executors, administrators or assigns have or pretend to have any right to any compensation whatever on account of the injury or damage that such stoppage of the flow or supply of surplus water may occasion.”

The mills at Cornwall might refuse to pay rent, as the ice barriers sometimes close the entrance to that canal, so that the water has run down to three and four feet upon the mitre sill at the head of it, also the ice jams in the river at the foot of canal, and diminishes the power, which might be made a ground for not paying rent.

The Chaffey privilege, some distance further down the river, on the Rapide Plat Canal, occupied by Mr. Gibson and Mr. McKenzie, paying \$245.00 per annum, might with equal justice have refused to pay rent, for the last 22 years—that privilege is subjected to more fluctuation than the mill privilege alluded to,—the Jessop—insomuch that the only means of supply are the valves in the locks, while at the other canal there has been constructed a supply weir for the benefit of this grant, and the mill privilege leased. Mr. Gibson stated to me that, in the twenty years they had been occupying the property, they had been idle for several winters for varying periods. In winter they are subject to the same loss of head, from the canal level being lowered through insufficient supply.

We will suppose that the Junction Canal affected the Jessop grant, what grounds would it be for not paying rent upon the other privilege, or what claim would the Starch Company have for damage done to Jessop? The property was bought by Mr. Benson after the construction of the Junction Canal, and he erected his mills subsequently. He applied for the four runs of stones previous to purchasing the Jessop property, he obtains a lease of this four runs subsequently, the Government supply him water in the same manner and subject to no more disturbing influences than upon other canals. According to Mr. Shanly's statement, if the construction of the Junction

On the supposition that the Junction Canal depreciated the Jessop grant.

Canal reduced the power at the lock from twelve to eight runs, he evidently bought only four runs from Jessop. Now, Mr. Jessop never assigned his claim for damages to Mr. Benson, for, in 1862, after the property had been sold to him, Mr. Jessop came forward again with his claim for damages, they were referred to the Law Officers of the Crown, and he was informed that his claim had been so referred, and that the Commissioner is advised that it cannot be recognized or entertained. Therefore, as the Government had laid off twelve runs at this place, before the Junction Canal was built, after its construction this power was reduced to eight runs, four of which the Government leased, leaving the Jessop grant a four run privilege, which he sold to Mr. Benson, Mr. Jessop urging his claims for damages four years after he had sold the property. If no assignment of these claims was made by Jessop to Benson, who bought depreciated property, which he should have known to be the case before purchasing, and the Starch Company should have known, after twenty years experience, in such a case they cannot set off rents, not paid, on property leased, for which they have bound themselves to pay a stipulated rental, knowing the grant they had purchased to have been depreciated.

I have traced this grant from the commencement; a valuable mill site, costing the country a large amount of money to create, and an additional amount to supply with water, was given for a valueless privilege costing some £20, where there had been only one run of stones in operation, and abandoned for years; that this privilege was never used until after the construction of the Junction Canal; that no claim for loss of head upon which the later occupants base their claim was made by Mr. Jessop; that the property was bought with the loss of head an accomplished fact, if the assertions of the claimants are to be accepted. That mills were erected with this knowledge, four additional runs leased, and an instrument executed by which they, the lessees, bind themselves to pay a certain rent. Now the assignees of this lease wish to set off \$3,520.00 due upon it for damages to which they have no claim.

We have now seen that, first, there was no damage; second, if there was any, the purchasers of this grant have no title to such damages; and third, that the Law Officers of the Crown held that the original grantee had no such claim.

Connected with the claims of Mr. Jessop, there were damages to land, and, with Mr. Benson, numerous disputes about land leased and supposed to have been leased, which I have not entered into, confining the question solely to the hydraulics.

The original grant states:-

"An upon this further condition, that if in consequence of accident or injury to, or the necessity for repairs or alteration of the said canal, or any of the works thereof, or from other inevitable necessity, the supply of water shall be diminished or cut off, the said James Jessop, his heirs or assigns, shall bear the loss or damage resulting from such diminution or cutting off the supply of water without recourse upon Us, our Heirs or Successors."

An inevitable necessity for a short time in winter diminishes the supply; navigation required that this canal should be extended some distance down the river; therefore, on both grounds there could be no claim. As stated previously, at the date of the grant, the power would be more variable and inferior to that after the Junction Canal was built, the canal being fed through the valves in the lock gates, similar to the six run privilege at Morrisburg, which has paid rent for over thirty years, and has now an appropriation for a supply weir, which the Lessee considers will render his power much more valuable.

In 1857, a supply weir was built close to the guard lock, to supply the twelve runs laid out at Point Cardinal, at a cost of \$8.0 per annum, chargeable to these mills and those at Point Iroquois, which greatly increased the value of these privileges.

To feed through the valves would require a head of $1\frac{1}{2}$ feet for the 120 horse-power laid off, using wheels of 75 per cent. for useful effect. The feed would be subject to stoppage when vessels chanced to be locking at both locks at the same time. The area of supply has been so increased that a head of 3 inches would

No claim by conditions of grant.

Supply weir constructed since date of grant.

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supply this 120 horse-power. During the season of navigation the average head is higher than this, so that since the construction of the Junction Canal, instead of being reduced as stated, from twelve runs to eight runs, the power has been increased from twelve runs to thirty runs.

There is, exclusive of the power granted and leased, power as constant and as valuable as at Cornwall, or upon any other canal where they are troubled with ice jams, anchor ice, &c., to be leased. This power may be called nine months' steady power and a three months' variable power. During January and February particularly, and March, the water some times runs down for some days in each month a foot or two feet.

One of the lowest water years upon record, 1872, the average water level upon the upper nitro-sill for January, February and March, was 7 feet 3 inches, with a 9-inch head, which would reduce the head upon the wheels at the mills to some 4 feet, sufficient water could be discharged into the canal for six runs of stones, or, by opening the gates as at other canals, there could be sufficient water for the whole twelve runs.

Now, this is an exceptional year, taking the average water level over a number of years, this is as constant a power as the majority of water-powers in the country.

The grant stipulates with regard to the eight run, that "The water wheel or wheels to be erected from time to time, shall be of a construction not requiring an excessive consumption of water, to be approved by our Commissioners of Public Works, for the time being, or competent Engineer by Us, or our Heirs, or Successors, for that purpose to be appointed."

The lease for the four runs provides for wheels that will consume the smallest quantity of water. Out of ten wheels there are only two that would be approved of—two Leffel wheels—while some of the wheels, those in the grist mill, will use three times the quantity that is necessary. The agent's statement is, that in summer they do not require to economize water, they having abundance of power, and have to run through the wheels sufficient water for the mills below, at Iroquois.

If the demand for power increases, there would be power to lease at this lock for nine months, which manufacturers might be glad to avail themselves of, to save fuel, they using steam for auxiliary power, the other three; it would be, in that case proper for the Government to insist upon the economy of water. When inspecting this privilege, the water running through their flume was equal to 180 horse-power.

Frequent application have been made to lower the level of the canal in winter, to give an increased head, as this would decrease the head at Iroquois, where, at present, an income of \$420.00 per annum is obtained, and no doubt a larger revenue will be obtained in the future; whilst this power has paid nothing, and will pay only \$160.00 per annum if the terms of the lease are insisted upon. It is, therefore, evident that it is to the interest of the Government to make no concession at this place, in the matter of lowering the head in winter, as it will be diminishing the power at Iroquois, all of which is a source of revenue to the country, while at Cardinal two-thirds yields no revenue, it being a concession from which as has been shown, the country has received no adequate return.

The power here, although shown variable, should be worth \$10.00 per horse-power. When, in 1853, the Chief Engineer reported in favor of the application of W. T. Benson, he set the price at \$4.00 per horse power per annum which was higher than now paid for power. Upon this report Mr. Killaly, the Assistant Commissioner of Public Works, endorsed:—

"I concur in Mr. Page's suggestion as to the disposal of the lot, &c., but I regard the rent he proposes as questionably low; by the arrangement proposed, the parties would have an exclusive monopoly to the whole water-power at this site, for only \$160.00 a year."

The revenue from this site should be \$400.00 per annum.

WILLIAMSBURGH

TABLE of Water Wheels, approximate discharge of Water and Number of Horse-Point, Rapide Plat

Name of Lessee.	Name of Sub-Lessee or Occupant.	Situation of Mill.	Date of Lease.	Term of Lease.	Description of Mill.	No. of Runs or Saws Leased.	Rent.
C. C. Farran...		Farren's Point Canal, Lock No. 22.			Grist Mill. Shingle Mill Woollen Mill.....	4 runs...	Free Grant.
Benj. Chaffey.	Wm. Gibson...	Rapide Plat Canal, Lock No. 23, Mor- risburgh.	Feb. 12, 1852.	21 years. July 1, 1849.	Flour Mills.....	8 runs...	240 00
do ..	do ..				do ..		
do ..	McKenzie				Saw Mill and Finishing Shop		
do ..	do ..						
W. Elliott.....	Bailey & Mills.	Galops Canal, Lock No. 25, Iroquois.	June 6, 1853.	June ., 1849.	Grist Mill.	4 runs...	140 00
John Molson...	Cameron & McLunis.	do ..	Nov. 12, 1853.	Jan. 1, 1852.	Saw Mill.....	4 runs...	140 00
Philip Carmen.	Pat. O'Keefe...	do ..	Aug. 22, 1865.	do 1, 1865.	Sash and door factory.	4 runs...	140 00
James Jessup..	Edwardsburgh Starch Co.	Lock No. 26, Point Cardi- nal.	Jan. 6, 1847.	.....	Starch Manufac- tory and Glu- cose Factory.	8 runs...	Free Grant.
Benson & Asphen.	do ..	do ..	Oct. 21, 1861.	Nov. 16, 1858	Flour Mill	4 runs...	160 00 826 00

CANALS.

powers Used, and the Machinery in the Mills drawing Water from the Barran's and Galops Canals.

of or ws ed.	Rent.	Description of Machinery in Mill.	No. of Hands Employed.	Description of Wheels in Use.					Water Dis- charged and Power.			Remarks.
				Description or Maker.	Name.	Number.	Size in Diameter.	Head.	Cub. Ft. of Water dis- charged per Second.	Horse-power at 75 p.c. for useful effect.	Horse-power Leased at 75 p.c. for useful effect.	
ns...	Free Grant.	4 runs and ma- chinery.	...	Leffel.....	3	56	3 6	135				
...	...	1 shingle machine	...	Woodenbucket	Central dis- charge.	1	54	3 6				
...	...	1 set of cards	...	do	do	1	66	3 6	97	66	40	
ns...	246 00	4 runs and ma- chinery.	...	Tyler.....	1	48	10 0	} 60			2 runs only used in stone mill.	
...	...	5 double sets of rolls, 2 runs on middlings, 15 bolting reels, 1 separator, 1 smut- ter, 1 brush, 1 ship elevator.	...	Woodenbucket	Central dis- charge.	2	48		10 0			
...	...			Leffel.....	3	56	10 0	263				
...	...	1 circular saw	...	Tyler.....	1	60	8 0	} 40				
...	...	Planer, rip saws, &c	...	Turbine	1	48	8 0		275	60		
ns...	140 00										40 Recently burned.	
ns...	140 00	1 circular, 1 shingle 1 butter, and 1 stave saw.	...	Woodenbucket	Central dis- charge.	3	50	8 0	272	186	40	Wheels of the worst description.
ns...	140 00	1 small circular saw and wood- working machi- nery.	...	do	do	2	48	8 0	73	49	40	do
ns...	Free Grant.	3 runs of stones, shakers, stirrers, and machinery in the manufac- ture of Starch and Glucose.	70		Turbine	1	66	6 0	49			
					Tyler	1	72	6 0	60			
					do	1	60	6 0	48			
					Leffel	2	56	6 0	120			
ns...	160 00	4 runs and machi- nery.	...	Woodenwheels		5	72	6 0	230	258	120	Wheels, rude and primi- tive.
	826 00					28				874	340	

WELLAND CANAL.

What has been termed the "Hydraulics," upon this canal, has occupied a prominent position in its history. It would, perhaps, be unnecessary in this instance, to allude to a past condition of things, were it not that several of the leases, existing upon the canal, extend back into the days of the Welland Canal Company, and are the relics of a system of administration which caused much criticism and numerous Parliamentary enquiries at the time.

Unlike the canals constructed by the Government, which were supposed to be solely for navigable purposes, the Welland Canal Company, in their original Act of incorporation, provided for the creation of water-powers; the large prospective amount to be derived in revenue from this source was one of the prominent inducements placed before the public, when the Company solicited subscriptions to stock for the construction of that work. The following extracts, the first, from a "resolution passed at a meeting of the Canal Board held at St. Catharines, 20th September, 1825," demonstrates the association of water-power and navigation in the construction of this canal:—

"In consideration, of the importance, of avoiding all occasion of dispute about the property, of the land bordering on the line which may be determined on for the course of the canal, betwixt the Deep Cut on the bank of the Welland River, and the harbor at the Twelve Mile Creek, on which line will be situated the valuable mill seats which are to be formed by the water admitted through the canal, and in order to prevent any question with the present proprietors of such lands, about the right of erecting mills, or other buildings, on sites which are to derive their value from the operations of the Company; considering that it is only just that the Company should enjoy the benefit arising from their own improvements, and that the powers granted to them, by their charter, were intended by the Legislature to secure the same: it is, therefore, *Resolved*, that 10 chains by 3, in front of the canal mouth, and 4 chains by 10 in length, be appropriated at its junction with the Welland River in Thorold, and two chains wide on each side of the canal reservoirs and the harbor."

In a published letter from Mr. Merritt to Mr. Wilkins, for the information of the people of Boston concerning the canal, the following extract is found:—

"Another most important branch of the profits is the hydraulic situations. There is not a mill seat from the Falls of Niagara round Lake Ontario to Dundas Creek on Lake Erie; the only one on this whole peninsula is the Falls of Niagara. In opening this cut we make innumerable situations for all manufacturing establishments, which will be the more valuable from the impossibility of competition."

Mr. Keefer, at one time President and one of the principal directors of the Company, in a printed address to the public, in 1823, states:—

"Another source of profit, to immediate stockholders, will arise from the judicious use of the superfluous water for the purposes of driving machinery, &c., and which by proper management, might be made to reimburse them, in a very few years, for the entire outlay of their capital. This taken in connection with the public convenience, in a part of the country where mill streams are both scarce and scant, is far from being one of minor importance. From Long Point, on the shores of Lake Erie, round to Dundas at the upper end of Lake Ontario, the only mill possessing a sufficient supply of water to carry on business to an extent that may be considered mercantile, is that of Messrs. Clark and Street, at the Falls." * * * *

"As this Company will be justly entitled to all the advantages that will result from the command of the water, throughout the route of the canal, the mills now erected on that part of the Twelve Mile creek (which will be benefited with an

additional supply of water), must be purchased at a fair valuation from the present proprietors, and be at the disposal of the Company, after the completion of the cut.

* * * * *

"The proceeds from the sale of the intermediate sites for hydraulic purposes, the increased value of the mills now erected, and the rental of the Company's two grand establishments on each end of the canal, will of itself bring in a handsome dividend to the stockholders, on the amount necessary to complete the whole."

In answer to a question put to Mr. Samuel Clowes, Engineer, by the Canal Committee, in 1824, he replied that,—"The most prominent situation for machinery, on the Niagara route, is at George Keefe's, Esquire, where they can be erected to any extent, but taking the whole into consideration, a decided preference must be given to the Twelve Mile Creek route, for hydraulic purposes, &c."

"In the report of the President and Directors of the Welland Canal Company, dated in August, 1825, it is stated:—"We connect an equal extent of country at a comparatively trifling expence, combine the most valuable and extensive hydraulic privileges, &c."

In a report by Dr. Strachan, the following extract appears:—"The situation for machinery on the line of this canal, both for local and natural advantages, is not equalled in America. There is not a mill seat on the whole peninsula, between those lakes, where a flouring mill can be established, which may be considered even mercantile, except at the Falls of Niagara."

Mr. Keefe's report, above referred to, estimates the annual rental of the mill properties at £2,800.

The Act of incorporation states:—"And also to select such convenient sites for such and so many mills, manufactories, warehouses, and other erections as may be required by the said Company for the purposes thereof, and to purchase the same to and for the use of the said Company."

Some time after the Company had commenced constructing the work, and they had received loans or financial assistance from both the Imperial Government and that of the united Provinces of Upper and Lower Canada; three Government Directors were appointed in the interest of the stock held by the Canadian Government, one of whom, at one period, was the celebrated William Lyon McKenzie. One result of his directorship and investigations was his formulating thirty charges against the Directors, Officers and Managers of the Welland Company, before a Select Committee of the House of Commons, which was appointed, in 1836, to enquire into the management of the Welland Canal.

The report of this Committee and the evidence taken before it, comprise a voluminous document of 575 pages, printed as an Appendix to the Journals of the House of Assembly, 1836.

These charges, the evidence and finding of the Committee, are foreign to this subject, with the exception of the "hydraulics," which occupies a considerable portion of the report. It would be unnecessary, to refer to even this portion of the report, only as before stated, we have the relics of that administration perpetuated upon the present canal. The Government having assumed the Welland Canal as a public work, and discharged the liabilities of the Company, the country has paid for the transactions which gave rise to these investigations. The cost of the "hydraulics" is included in the amount for which the people are taxed, by the country's discharging the liabilities of the Welland Canal Company.

The following extracts and evidence are taken from the Appendix to the Journals of the House of Assembly, above referred to, and from documents in the Welland Canal office.

There were considerable contentions with regard to the route of the Welland Canal from the summit near Thorold to Port Dalhousie. The following extracts are given to show that the longer and more expensive line was finally adopted, on the ground of its superiority for hydraulic purposes,

Hydraulic power
a factor in deter-
mining the route
of canal.

Francis Hall, C.E., in his evidence before the Select Committee, states:—

"That a better and more direct line could be made between those points, saving three or four miles in distance."

Mr. Barrett, C.E., employed by the Welland Canal Company, reported in 1821 in favor of the Twelve Mile Creek route for "hydraulic purposes."

Samuel Clowes, an engineer also employed by the Welland Canal Company, reported, in 1825, as follows:—

"Taking the whole into consideration, a decided preference must be given to the Twelve Mile Creek route for hydraulic purposes."

Mr. Proctor, agent for the Company in New York, transmits a letter in 1825, embodying the views of the shareholders of that city in reference to the location of the line of the Welland Canal, from which the following is an extract:—

"A straight course, as near as may be, taking into estimation the comparative expense of each, ought to be taken in preference to any circuitous one, and that no water privileges ought to induce the adoption of a longer route. They believe that the water could be applied with equal advantage for mills on the short route as on the circuitous one. In making these remarks on the route, they, however, by no means think lightly of the water privileges; on the contrary, they think them very important, and are desirous that the cut across the ridge should be deep and wide enough now to supply a sufficiency for the purpose, both of navigation and mill seats, for many years to come."

The recommendation of the New York shareholders appears not to have been carried out; the longer, or Twelve Mile Creek line, was adopted for the canal, chiefly, among other reasons, for its hydraulic advantages, instead of a shorter and cheaper line.

Mr. Mackenzie in evidence states that a petition to a Committee of the House of Assembly, dated the 22nd November, 1822, from Captain Gordon contained the following: "Your honorable House may be pleased to cause a faithful survey and estimate for carrying the line of canal from the base of the mountain, in as direct a line as may be, down one of the ravines terminating at the mouth of the Twelve Mile Pond instead of turning around through St. Catharines; there being no perceptible difficulty, save the cutting off that village, the aggrandizement of which can be of no importance to the company's general interest."

Mr. McKenzie with reference to this petition remarks:—

"Had the suggestion of this excellent man been followed, and the direct route from Centerville to Port Dalhousie surveyed and estimated, the Welland Canal would have been shortened nearly five miles in a distance of nearly six or seven on the side of Lake Ontario, and many thousands of dollars in damages and sudden injury to the works, by the freshets on the Twelve Mile Creek, avoided. But so powerful was Mr. Merritt's influence with the Attorney General that the most difficult, circuitous and improper route was at once adopted, without even an examination of the direct line, and the public suffered a permanent loss of many thousand dollars in order that Mr. Merritt's mills might find a purchaser and his landed property be enhanced in value. At one end of the canal it is extended four and a half miles to benefit Mr. Henry J. Boulton at the cost of the country—at the other it is entered nearly four miles more to serve the private interests of Mr. Hamilton Merritt. * * * * * Mr. Hall's report explains the great advantages to be derived from adopting the direct route even now, and I fully concur with him in opinion."

It may be concluded that the route of the canal becomes an element in the cost of the "Hydraulics."

A large amount of money, chargeable to some extent, to the hydraulics of the canal, arose from a sale made by the Company of all the land and water-power along the line of canal. This forms Mr. McKenzie's 18th charge, which is: "That a bargain deeply injurious to the interests of the Company, and of the Province as connected therewith, has been attempted to be carried into practice, by which valuable property granted to the Company at Port Colborne, and other lands and water-powers would be alien-

The first Hydraulic
company estab-
lished.

ated from the Company, and many thousand of pounds of debt incurred by them without value being received therefor."

This transaction consisted in the Company's conveying to A. McDonnell, Esq., for F. B. Yates, Esq., who was the purchaser and an alien incapable of holding, all the land and water-power, not required for canal purposes, for £25,000, to be paid in ten years. The Company, in a short time afterwards, re-purchased the property. The Committee's finding upon this charge was:—

"About eighteen months' interest upon this sum is said to have been paid, and principally refunded in the shape of bonuses for damages, said to be sustained for want of water; that it further appears that on the 9th day of June, 1834, the Company relinquished their claims for £25,000, and bought back the lands and water privileges with the exception of 200 acres, being the town plots of Port Colborne and Allanburgh, which are of great value, and some valuable mill sites, as detailed in the evidence, they giving the Company's bonds to Mr. Yates for the payment of £17,500 with interest. This transaction to your committee is inexplicable, no statement that they have heard has satisfied them of the justice, or even expediency, of an arrangement which, if applied to the ordinary transactions of life, would not only be deemed ruinous but the result of insanity. The value of property sold, or the amount of profits received, by the Hydraulic Company is quite uncertain. Your committee are of opinion that it is well worthy the consideration of your Honorable House how far it would be advisable to take immediate steps to cancel the whole agreement."

From the records of the Welland Land Company, I find that on the 11th May, 1831, at a meeting of Directors, A. McDonnell being present:—

"That no proposal having been received as advantageous as Mr. Yates', it be received."

From the records of a second meeting, 2nd June, 1831, A. McDonnell, President, present, the following resolutions were passed:—

"10th. Resolved, That a surveyor be employed to designate and establish the boundary of the canal throughout, under the direction of Mr. McDonnell, who will submit the plan of the same for the sanction of the Board as soon as completed."

"11th. Resolved, That a deed of the above lands be made out to A. McDonnell, at the request of J. B. Yates, he not being authorized to hold real estate in this Province, and that a bond and mortgage be made and executed by Mr. McDonnell for payment of consideration and interest, and that Mr. Yates execute the same with him."

I find a document which does not appear in evidence before the Select Committee, copied in the records of this Department, in connection with the present "St. Catharine's Water-power Company's lease," namely, a memorandum of agreement between Yates, Creighton and McDonnell, the latter two being Directors of the Company:

"7th June, 1832. Witnesseth, that the property and hydraulic power already conveyed by the said Welland Canal Company to the said A. McDonnell shall be held by him for the benefit of the rest. The whole property shall be divided into 250 shares of £25 each. Yates 164 shares, McDonald 66 shares, and Creighton 25 shares."

Minutes of meeting, 7th June, 1834, McDonnell and Creighton present:

"From the desire to place the entire control of the canal in the hands of the Government, and the re-purchase of lands and hydraulic privileges: Resolved, that the Government Directors be a committee to negotiate with the proprietors of the hydraulics for purchase of the same."

This committee approval of the re-purchase for £17,500. Bonds bearing interest for this amount were given by the Welland Canal Company, and redeemed by the Government, this transaction costing the country £20,000, for which the Welland Canal Company received nothing in return.

Francis Hall, Esq., the Engineer, was asked before the committee:—

"Did you become acquainted with any valuable improvements made to the Canal Company's property, by the Hydraulic Company during the time they held

the lands and water-power?"—"I have not heard of any, and none has been pointed out to me, as far as I can remember."

The finding of the committee on this point, was that:—

"What had been received in interest was returned for alleged damages, valuable property and water-power was retained, exclusive of the £17,500 given to this Company, over one-half of the stock of which was owned by Directors of the Company."

The Directors of the Welland Canal succeeded in obtaining an Act of Parliament, 4th March, 1837, Wm. IV., cap. 92, intitled: "An Act to provide for permanent completion Welland Canal." This Act contains a clause sanctioning the repurchase, which reads:—

"Whereas it is of much consequence for making the said canal effective, that the entire control of the water passing through the same, shall be at all times within the power of said Company, and to that end it is desirable that the several situations along the line of the said canal, possessing hydraulic advantages, and which have been heretofore alienated by the said company, should be again acquired by them, in order that the same may be leased, upon such terms, as will prevent any danger of obstruction to the use of the canal. And whereas the proprietors of sites, and situations, possessing the hydraulic advantages, have signified their willingness to reconvey the same to the said Company, with all buildings, works, and improvements erected thereon, upon the consideration that they shall receive, from the said Company, the amount of money paid by them for the purchase of the said sites, and for the improvements which they have placed thereon."

In July, 1837, a warrant was issued by the Governor General, to pay £20,000,—interest payable from July 15th, 1837,—to discharge the claims of the Hydraulic Company.

All leases of water power, executed by the Welland Canal Company, between the date of re-purchase and this sanction by Act of Parliament, contained a clause for annulling them, on condition of the Company's paying all expenses, in the event of the Legislature refusing to sanction the re-purchase.

St. Catharines Water Power Company.

The foregoing is a brief history of the first Hydraulic Company in Canada, from which the country has had to suffer. This re-purchasing brings us down to the inception of a similar company on a smaller scale, which still exists, known as the "St. Catharines Water Power Company."

On the 1st February, 1830, at a meeting of the Directors of the Welland Canal Company, it was,—

"Resolved, that the Engineer be empowered to lay out a raceway at St. Catharines, in the most suitable situation. The mill seats to be sold by public auction on Saturday, the 5th June, the digging to be let out on the 15th April, *but not to be paid out of present funds*"

This was a raceway purely for hydraulic purposes, made at considerable expense, and, as will be shown hereafter, without any regard to the principles of hydraulics. It was excavated in the interests of the Welland Canal officials, and subsequently, entailed heavy expenses for repairs and maintenance.

On the 4th July, 1834, the Directors accepted a proposal from certain parties, for the water from this raceway; accordingly, in this year, a lease was executed to be renewable every ten years. This lease, of which the present St. Catharine's Water-power Company are now the assignees, with others, led to the seventeenth charge by Mr. McKenzie, as follows:—

"That the President, Agent, and some of the Directors, have been improperly employed in forwarding goods on the canal, and in leasing the water-power thereon, while acting as such officers."

The finding of the Committee on this seventeenth charge, was:—

"Your Committee have no hesitation in stating that, in their opinion, it is highly improper, for any of the officers, to be in any way connected with the water

privileges or transport upon the canal,—that they ought to be above the suspicion of having any interest to serve, beyond those of the canal proprietors,—that some of them have been, and still are, so interested, there can be no doubt."

The water discharged from the race, sufficient for three runs of stones, was leased, for £150 per annum, to Mr. O. Phelps, a prominent contractor upon the canal. This Phelps' lease extends to the present time, and will be more fully dealt with subsequently.

On the 24th September, 1829, the Board of Directors resolved that the mill privileges on the line of the canal be let for a term of ten years. Grist mills for each run of stones to pay £100 per annum, yet Mr. Phelps' lease was granted at one-half the rental. In 1831, the flouring mill, known as the "Red Mill," was erected by Messrs. W. H. Merritt and O. Phelps. This ditch, or raceway, was constructed for this mill, and the others included in the lease of the St. Catharines Water Power Company. With reference to the latter, Mr. McKenzie, in his evidence before the Committee, states:—

"I met in the canal office with an indenture having the Company's seal affixed to it, but no other seals nor signatures. It is dated 22nd September, 1834, and I find that of the persons to whom a lease of the St. Catharines water-power is given by virtue of that document, there are of the company's officers, and persons employed by it, Messrs. John Clark, Thomas Merritt, R. E. Burns, and Robert Sanderson. The lease conveys to them, for £125 a year, subject to be annulled by the Legislature, the land and premises, with the water-power attached thereto, at St. Catharines, commencing at the level below Mr. Phelps' saw mill race, down to any part of the level below the hill at St. Catharines where the bridge passes the Hamilton Road, with all the waste water. The Canal Company are to do a variety of work for the lessees. The rent is only £125, the lease for ten years, and the Canal Company are to pay the value of the erections in case it declines to renew the lease. Under this indenture Mr. William Hamilton Merritt is a lessee of water here also."

Mr. Francis Hall was the first engineer who made a report upon "the Welland Canal "Hydraulics." This report is dated 24th October, 1835, it was made to the Government Directors of the Canal, and gives in detail the mill seats upon the line of the Welland Canal. He states:—

"The St. Catharines Water Power Company occupy all the waste water upon levels Nos. 4, 5, and 6, and with a fall of 22', 6"; also all the waste water at Lock No. 24 near the summit level; the water is conducted to the first series of mills, by an open cut 2½ miles in length, at an expense to the Canal Company of about \$6,000 exclusive of land. The Water-Power Company have constructed, at their own expense, three separate races in connection with the Company's race. These valuable and extensive privileges are possessed by the Water-Power Company, at a very moderate rate."

Before the Select Committee, in 1836, Mr. Hall was asked:—

"Do you think that considering the very great expense to the Canal Company, of the St. Catharines' feeder and temporary aqueduct, the extent of the water privileges it gives to Mr. Merritt, Mr. Phelps and the other occupants, anything like a reasonable compensation is obtained for the very valuable and extensive powers thus conceded?"

"So far as I can make out, the estimate for that work, the expense has been about £1,635; the interest upon this should be at least 10 per cent., or £169, independent of repairs. If only £125 is given, it is too little."

Reference to this Company is contained in a letter from the Superintendent of the Canal to the President of the Company, dated 6th September, 1837, which states:—

Evidence of the Superintendent of the Canal.

"I have been applied to by Messrs. Phelps and Mittleberger to repair certain parts of the mill race, but have declined doing it until the Board should satisfy themselves, how far they are liable for such repairs. My own opinion is, that it would be far better to say, to proprietors of mills who depend

upon this source for their water, that the Welland Canal Company have no objections to dispose of the race (which was especially made at the Welland Company's expense), on fair terms, and on express conditions, that they, the proprietors, should be at all expense of repairing. There are two aqueducts on this race—one 400 feet long and 50 feet high in the centre; the other of much less dimensions, though by no means easily kept in repair. Both of these are built of pine timber, and will in a short time require extensive repairs, and in two or three years require rebuilding entirely. I would therefore respectfully recommend the Board to satisfy themselves as to the propriety of the Welland Canal Company expending such large sums in a manner no way connected with, what I conceive, the objects and intention of the charter. I contend that we ought to charge for the waste water when it leaves the canal at the regulating flumes, and is delivered into the different mill-races, but that we have nothing to do with taking care of it afterwards. A contrary course will entail heavy and unceasing demands on the Company, which I believe it is improper to grant. This is, however, my own opinion only, but I am anxious to receive the definite orders of the Board on the subject, as there are large arrearages of water-rent due, and withheld from the Company until the question is decided."

The next reference to this lease, by a professional gentleman, is in a general report upon water-power supplied from the canal, made in March, 1846, after the canal passed into the hands of the Government, and during the enlargement. This report is by S. Power, the Engineer of the canal, in which he states:—

"It is necessary for me to direct the attention of the Board to certain clauses in the lease held by the Hydraulic Company; almost all the valuable water-power described in Table No. 2, viz.: the surplus water between old lock No. 24 and the village of St. Catharines is leased, and thus deprives the Board of the power of selling or renting any of the valuable mill sites which the recent improvements have rendered available. The clauses are quoted in an appendix to this letter. The matter is, of course, one for the consideration of the law officers of the Board. I only intend to point out the apparent difficulties, &c., &c."

On the 1st January, 1847, S. Keefer, Esq., being Engineer of the canal at that time, writes to the Secretary of the Board of Works:—

"It may be proper to state, however, that the lease held by the Water-Power Company, of St. Catharines, from the Welland Canal Company, entitles them to 'all the surplus water not required for the navigation of the canal and for the Oliver Phelps' saw mill,' which is to enter into the hydraulic race at old lock No. 24 at the mountain. This is, indeed, an extensive and uncalled for concession, but still there are two good and sufficient reasons why the privilege thus conceded should not deter the Board from granting to Mr. Phelps the power sought for, or from granting similar privileges elsewhere along the canal, between the said saw mill and old lock No. 24, if called for."

"First,—That the saw mill consumed as much water as the flouring mill requires, and, according to the terms of the lease, the Board has reserved the right of using that quantity, at least, of the surplus water."

"Second,—It would be impracticable to send down the hydraulic race all the surplus water of the enlarged canal. One-half of that surplus water would carry away every mechanical structure on the line of the race and destroy it."

On the 28th January, 1847, Mr. Keefer, in a general report to the Commissioner of Public Works upon the water-powers along the line of the Welland Canal, refers, in the following words, to the St. Catharines Water Power Company:—

"Connected with this subject, and a matter seriously affecting the interests of the Government, I now beg leave to call your attention to the terms of a lease given by the Welland Canal Company to the Water Power Company of St. Catharines, dated 28th November 1834, a copy of which is sent for your information. It will be seen that for a consideration of a yearly rent of £125, the Water Power Company are entitled:—

"1st. To the free use of the surplus water of the canal passing around the three old locks, Nos. 4, 5 and 6, (now two locks, Nos. 3 and 4), between Oliver Phelps' grist mill and the basin at St. Catharine's ;

"2nd. To the use of all the water discharged from the hydraulic race at Oliver Phelps' grist mill, which the Welland Canal Company, at their own expense, are to deliver into the second race on a level with the tail race of that mill, and

"3rd. To the use of all the surplus water 'not required for the navigation of the canal, and said mill of Oliver Phelps' (now Reynolds') 'to enter into the upper race which is or may be conveyed therein near the mountain in the township of Grantham, being immediately above lock No. 24—now at the cement mills above lock No. 17.

The duty of keeping the hydraulic race and aqueduct in repair falls upon the Welland Canal Company, and up to the present time the costs far exceed all the rents that have been paid.

A very extensive power has thus been conceded, and the Government stands in a position, with reference to the Water Power Company, worse than if this surplus water had been given away to them, thus being obliged to continue it, and maintain the races, at their own expenses; moreover, the lease is perpetual.

A literal interpretation of its terms would give to the Water Power Company *all the surplus water* from the head of new lock No. 17 to the level below new lock No. 3, comprehending a fall of 189 feet, distributed over a distance of $3\frac{1}{2}$ miles, and a power equal to that of — horses, excepting that there is reserved to the Welland Canal Company the use of as much water as would propel the said mill of Oliver Phelps, situated at lock No. 7 (now No. 5), but even this exception has been contested, on the ground that it has reference only to that mill while in existence, and that when it was done away with, the water which propelled it reverted to the Water Power Company. If this contention could be admitted, then, by a parity of reasoning, when the old lock, No. 24, was done away with, the Water Power Company were no longer entitled to any water from thence. It may, therefore, be concluded that the Government can, with propriety, sell at least one privilege, equal to the power of the said mill, at each of the intervening locks; but when it is considered that the race is incapable of taking away all the surplus water, and that the Water Power Company have no right to any water but what enters into the race, it appears conclusive that it may all be leased, so long as there is no lack of a supply in the race.

Now, we discover an incongruity in the conditions of the lease which renders a literal construction ineffectual.

The capacity of the race, and particularly of the aqueduct, is not sufficient to convey more than one-quarter of the surplus water, now that the canal has been enlarged, and to discharge into it all the surplus, would cause its destruction. Starting from the mountain, the race passes over a deep clay soil, and the fall being very rapid at the beginning, it has been found necessary to check the velocity of the current by a series of waste weirs, which are subject to frequent derangement, and have repeatedly been undermined and carried off. The strong current has excavated deep gullies in the soil, and if this action is not further abated by the erection of more weirs, the evil will grow to an alarming height, and ultimately endanger the safety of the canal itself. There never was any necessity for taking the water out of the canal so high up the mountain. It would have answered the purpose just as well, and better, to take the supply from the canal at Centreville, above lock No. 11, and thus avoid the inconvenience of a fall of $76\frac{1}{2}$ feet, and the expense of making and maintaining the worst part of the race.

My object in going into these details, is not by any means to censure those who were concerned in granting the leases. Far from it. Perhaps, under existing circumstances, it was the best thing could be done to give a start to those manufactories which have proved so beneficial. But I have done so with a view to pointing out the expediency of having the lease altered, so that the Water Power Company may be supplied from the lower level at new lock No. 11. To this change they can scarcely raise any objection, and then the question, as to the right of the Govern-

ment to the use of the surplus water above that point, can entirely and forever be set at rest."

In 1850, the Hon. H. H. Killaly being Superintendent and Engineer of the Canal, the period of the old leases on the Welland Canal having expired some time previously, and the hydraulics of the canal requiring to be placed on a business footing, he sent to the Board of Works a list of all the mill sites, with memoranda and references to each.

Evidence of the Hon. H. H. Killaly Engineer & Superintendent of Canal.

Upon this lease his memorandum states:—

"These concerns are all under the St. Catharines Hydraulic Power Company, who pay to the Department the annual rent of £125, for the entire. Were the machinery, now in operation under it, to pay at the rates fixed by the late Order in Council, the aggregate rent would be £325 per annum; the present rent by no means covers the cost of repairing and maintaining the hydraulic race."

Sufficient evidence has been cited to show the character and results of the lease from the Welland Canal Company. Evidence will now be adduced, pertaining to the granting of the present lease.

In May, 1847, an indenture was drawn up between the nominal holders of the lease from the Welland Canal Company, and four others, which reads:—

"These parties of the first part, for and in consideration of the sum of five shillings, (the amount of the capital of the said Water Power Company, £292 10s. consisting of 39 shares at £7 10s. per share), to them in hand paid by the parties of the second part, at and before the sealing and delivery hereof, the receipt whereof they do hereby acknowledge, have and each of them hath remised, released and forever quit claim unto the said W. H. Merritt 17 shares, Hon. Peter McGill 12 shares, John Gibson 5 shares, E. S. Adams 5 shares, making in all 39 shares of the said parcel or tract of land, premises, water-power, together with all and singular the building, and appurtenances thereunto, belonging and the rents issues and profits thereof."

On the 19th November, 1850, Mr. Killaly writes to the Secretary of the Board of Works as follows:—

"The daily increasing demand for surplus water on the line of this canal, and cost of maintaining the race by which the water is furnished, (heretofore for its whole extent borne by the Department), together with the very indefinite terms of the deed by which the water is granted and held by the Water Power Company, render it most desirable that a new arrangement should at once be made with the Company, by which the respective rights of the Company should be distinctly defined.

Heretofore and at present, the Company, by the indenture of the 28th November, 1834, is entitled to have all the water not required for the canal or navigation purposes sent down through the hydraulic race from the head of old lock No. 24, or head of new lock No. 17. The water so passing from this level through a purely clayey soil, has made tremendous excavations, and in some places jeopardises the safety of the canal.

It is evident, therefore, that it is most desirable to get rid of as much of this hydraulic race and its maintenance as can possibly be done without interfering with the rights of the St. Catharines Water Power Company.

The first mill established below lock No 17, is supplied from the head of lock No 10. I propose that a new understanding be had with St. Catharines Water Power Company, and when eventually agreed to, that the present deed be cancelled and a new one entered into, by which their right, or supposed right to all the surplus water from the present lock, No. 10, down to the tail of lock No. 3, be established, saving and using only the water-power at lock No. 5, sufficient for two saws, lately purchased back by the Department, and now leased under the authority of the late Order in Council, and that the surplus water, instead of being as now, turned into the hydraulic ditch referred to, at the head of lock No. 17, shall be turned into it at the head of locks Nos. 10, 11, 12, as may be found most expedient, and that the said St. Catharines Water Power Company waive, and yield up, all claims whatsoever to the use of any surplus water from Lock No 10, to the head of old Lock No 24.

The advantages to the Department by this arrangement would be, that a considerable length of the hydraulic ditch would be got rid of, and its sole and undisputed right to the use or letting of the water from lock No. 10 upwards, would be clearly established.

With the view of effecting such an arrangement, so very desirable in the interests of the canal, as it appears to me, I have had communication with Mr. Gibson, the President of the St. Catharines Water-Power Company, and I hereby enclose a memorandum of agreement, which that gentleman, after consulting with the parties interested, is willing to subscribe to, should it meet the approbation of the Department.

I respectfully request that I may be favored with the decision of the Commissioners which it is important should be as soon as due consideration and their convenience will admit of, as some preparation must be made for turning the water from the canal at lock No. 12, before the winter sets in.

"In case the Commissioners should choose adopting the arrangements proposed, I would have a rough draft of the necessary deed made out and submitted for their approval.

On the 9th January, 1851, the Secretary of the Board of Works solicits the opinion of the Hon. Attorney-General, on the salient points of the lease of 1834, in the following letter:—

"I have the honor to transmit, herewith, by the direction of the Commissioners, a copy of lease passed in the year 1834, between the Welland Canal Company and the St. Catharines Hydraulic Company, for your consideration and opinion upon the points hereinafter specified. A plan is likewise sent, showing the position of the locks, &c., as well as a section to show the mode of taking the water through the raceway from above lock No. 24 of the old canal.

The lease referred to grants "all the waste water not required for the canal, which is now or may hereafter be discharged from the upper level or race above Oliver Phelps' mill." Also, "all the land in the village of St. Catharines," as described in portion which extends above lock No. 4. The lease also states, that the said Welland Canal Company do further bind themselves to allow the free passage of all the surplus water not required for the navigation of the canal, and the saw mill of Oliver Phelps, to enter into the upper race, which is or may be conveyed therein, near the mountain in the township of Grantham, being immediately above lock No. 24.

At the period when the lease above referred to was passed, 1834, the Hydraulic Company could not have anticipated any further increase in the quantity of water than the old canal would afford. But the canal having been reconstructed on a plan which gave fully three times the surplus water that the old canal could possibly have supplied, the Commissioners wish for your opinion as to whether the Government is bound to give the Hydraulic Company the benefits of the whole quantity which can now be afforded, and whether the extra two-thirds can be legally disposed of to other parties.

The waste water which now delivered into the race-way above lock No. 17, (No. 24 of the old canal), is only available on the Hydraulic Company's property, at the level of lock No. 11. The ground between these two locks, on which there is a fall of 72 feet, is of such a nature that it will not admit of carrying the water through the raceway at the level of lock No. 17, or of bringing it to the Company's mills at a higher level than lock No. 11, as the fall, between these two locks, is great, (72 feet), the distance short, and the declivity in the raceway considerable, the extra quantity of water passing through it, very much endangers the safety of the canal. I have, therefore, to enquire whether the Government can take the water into the raceway at lock No. 11, instead of lock No. 17, provided that the power, either in the head or fall, or in the quantity of water supplied, is not in any way diminished, or the Company put to any extra expense.

Supposing that the water can be taken into the hydraulic race at lock No. 11, instead of lock No. 17, can the Government make it available around the intervening

locks, Nos. 12, 13, 14, 15 and 16, and let it off to other parties for the purpose of increasing canal revenue?"

The opinion of the Attorney-General, in reply to the above enquiries, I have not been able to discover. The authority of the Secretary for submitting the enquiries to the law officer of the Crown, is found in the minutes of the meeting of the Board on the 7th January, 1851, as follows:—

"Hon. Mr. Merritt present: The Secretary was directed to transmit to the Attorney-General, the lease of the St. Catharines Hydraulic Company, with a plan of the raceway by which the water is now supplied to the Company, and to request his opinion on the points specified in the draft now submitted."

On the 14th May, 1851, a lease was executed with this Company by the Hon. Messrs. Burrett and Killaly, as Commissioners, but this lease never received the sanction of the Council.

Present lease executed.

From the foregoing evidence, it is seen, that under the old lease, the Company had all the water in this race, discharged from the mill of Mr. Phelps, and a part of the surplus water of three levels upon the old canal, equal to two levels upon the new. By the present lease, they receive the water upon seven levels of a canal of much larger capacity, a greater quantity of surplus water, together with an increased flow through the race, for the same rent as paid under the old lease, viz.: £125, and this in the face of opinions contained in the reports of three successive and previous Engineers of the canal, viz.: the report of the Hon. H. H. Killaly, in the previous year, in which he says, as hereinbefore quoted:—"The rent should be, if paid at the rates stated by an Order in Council, £325"; the report of Mr. Keefer, in 1847; the report of Mr. Power, in 1846; the report of the Superintendent of the canal in 1837, together with the evidence of Mr. Hall, before the Select Committee, in 1836, wherein he states the rent paid by the Water Power Company, to be less than the interest upon the first cost of construction of the hydraulic race, consequently a portion of the cost for maintenance and repairs was a direct tax upon the canal, while nothing was paid by the Company for the value of the mill seats and water power.

The original cost of this raceway has been shown by the estimate of Mr. Hall, but does not appear in the Welland Canal books, as the minutes of the Board directed,—“That it must not be paid out of the present funds,” hence its cost remains indefinite.

What this lease cost the country has to be determined. Take the original cost of the race as given by Mr. Hall,—\$6,000.

Expenditures for the St. Catharines Water-Power Co.

The Government re-built the aqueduct in 1843 or '44. I am unable to ascertain the exact expenditure in this case, but approximately, it was \$1,500.

Although an agreement was made upon the 22nd December, 1829, between the Welland Canal Company and freeholders of lands at St. Catharines and vicinity, to allow the Company to cut a raceway through their lands, not more than 20 feet wide, an agreement which would appear binding,—but the legal question must have been considered at that date. In reference to this agreement, Mr. Killaly writes to the Commissioner of Public Works, the Hon. W. H. Merritt, under date of 19th November, 1850, the following:—

"Several parts of the embankment of the hydraulic race, the maintaining of which rests with the Department, require raising and strengthening. I have taken every pains to ascertain the nature of the condition and authority under which this ditch was originally made, and, as far as I have been able to learn, the then proprietors of the soil bind themselves by an instrument to allow the water to be passed through their lands through which the drain was to pass. The land has now passed into the hands of several other parties who positively refuse to allow it to be cut or interfered with, for the making up and strengthening of the banks of the ditch when necessary. Under those circumstances I had the land visited by the Arbitrators lately, with a view of their putting a reasonable value on it, and I now suggest the propriety of my being authorized to mark out a strip along the race, and to make

the respective parties an offer, based upon the valuation of the Arbitrators, which may save delay or any further reference to arbitration in most cases."

In this case I find that the award of the Arbitrators for land amounted to \$4,185.50.

The outlet from the canal at the head of this raceway being changed, a new supply weir was built at a cost of \$2,632, and other works, the cost of which is indefinite.

In 1861 another aqueduct was built at a cost of some \$1,500.

It is impossible to arrive at some of these expenditures accurately, and equally impossible to arrive at expenditures for yearly repairs and maintenance, as no separate account is kept for expenditure upon this raceway, but is charged to the maintenance of the canal. It is only by looking over a number of papers, estimates, &c., that an idea can be formed. Some of these papers show the Government were doing, if it were done, the work which the lease provides the Lessees shall do. For instance, I find a sheet of cross sections with some 6,795 cubic yards of excavation for raising the embankment of the Merritt race.

The wooden aqueduct was expensive to maintain; it had a life of some 18 years, while the life of the box or flume was still shorter. Breaches were being continually made in the banks, which had to be repaired. The race had to be cleared out every second year. Men had to be employed, during winter, to keep the canal clear of ice; one man was so employed continuously, for four months in winter, at \$38 per month, or \$152 for the season, and during the prevalence of cold periods six to eight men were so employed. The clearing out of the raceway every second year cost some \$800. These items do not include the additional expense of maintenance of the seven levels upon the canal, granted in the lease. As an example of yearly expenditure in connection with the raceway, the following quotation is taken from the Report of the Superintendent of the Canal for 1881, which is a fair specimen of the yearly average:—

"HYDRAULIC RACE AND AQUEDUCT."

"Two dwarf stone dams put in to check scouring of banks.

"Bottom renewed and side of aqueduct flume repaired and caulked.

"Supporting bents and frame of flume pieced out and repaired.

"Ice kept clear, night and day, from aqueduct to Red Mill.

"Seventy-five feet of dry stone retaining walls built on each side of Thorold road bridge.

"Stone abutment of aqueduct repaired, portable float made for repairing uses.

"Stringers of farm crossing bridge, 35.0 x 12.0, renewed and newly planked. New bridge built at head of aqueduct, 65.0 x 12.0.

"Barbed wire fence and iron posts put up in parts of race to keep off cattle."

From the Water Power Company and the Phelps' lease only \$350 as proportioned subsequently, are received, or not sufficient to pay for men's wages in clearing the race and keeping it free from ice in winter. In addition to this, is the large expense of keeping the aqueduct and the banks in repair.

If we take \$15,000 as the capital which was invested in this race, and take 10 per cent. for interest, repairs and maintenance, adding the cost of clearing out, \$500 per year, together with the wages of men looking after the race in winter, we have a yearly outlay of \$2,000 for which the country has received only \$350, leaving a balance of \$1,650 which the tax-payers were contributing, annually, to the Water Power Company and the Lessee of Phelps' mill, in addition to which the country receives nothing for ground rent of mill sites, or the water used for power. One of their principal Lessees keeps in repair his own race, and the Company have the maintenance of only two small raceways, they have not been engaged in advancing the manufacturing industries of the country, but in the receipt of the difference between \$500.00 and the amount paid them by their Lessees.

It is seen from the indenture of May, 1847, when Messrs. W. H. Merritt, Peter McGill, John Gibson, and E. S. Adams for the sum of five shillings received the

release and quit claim of this property, their capital was only \$1,170. It is therefore evident, that with this small capital, little was intended to be done to develop the water power.

It is necessary to investigate the rights of the Company in detail. As before quoted, with reference to the original lease from the Welland Canal Company, Mr. W. Lyon McKenzie states:—"I met in the canal office an indenture having the Company's seal affixed, but no other seals or signature."

I have found, in the Welland Canal Office, an indenture with the seal of the Company affixed, signed by the President of the Company, Mr. W. H. Merritt, and witnessed, but with the seal and signature of the President erased.

The lease granted that all the surplus water not required for navigation, except the quantity required for a saw-mill, should be discharged into the raceway, conveying also to the Company the land and surplus water of three levels. The race was supplied from level No. 24 of the old canal, the saw-mill was upon level No. 7, and the three levels leased were Nos. 4, 5, 6. If these conditions were observed, it is evident that between level No. 24 and level No. 7, all the surplus water running would be the amount required for the saw-mill. When the Government enlarged the canal, the conditions were changed, level No. 24 became level No. 17, levels Nos. 4, 5 and 6 became levels Nos. 3 and 4, and the supply of water, available for mill purposes, was largely increased. Mr. Keefer, in his Report for 1847, states:—

"The capacity of the race is not sufficient to carry more than one quarter of the surplus water running since the canal is enlarged."

I deal with matters which might be considered to have been settled by the lease of 1851, it being *ultra vires* the rights of the company as shown subsequently are to be determined by the original indenture. On a question of principle, upon the former enlargement, the conditions are something similar to the present enlargement. As before quoted, Hon. W. H. Merritt directed the Secretary of the Board of Works to obtain the Attorney-General's opinion upon certain points as to the rights conveyed by original lease, an opinion which, whether given or not, I have been unable to find. When the Government assumed control of the canal they changed its character in every respect,—levels different, the supply of water greater, it would appear reasonable that this lease was entitled to draw through the raceway, the same quantity of water as before the canal was enlarged, and use upon levels Nos. 3 and 4 the amount of water discharged through the wheels of the mill for which water was granted.

From the great declivity of the race, the condition of which was seen by Mr. Keefer's report, it was necessary to change its junction with the canal some distance further down to lock No. 11. Some claim must have been made to the surplus water between locks Nos. 11 and 17, for there is an indenture in which the Hon. W. H. Merritt and other parties mentioned in the indenture of 1847 "assigned their right, title and interest in and to the use of any and every portion of surplus water above the head of lock No. 11." This indenture is dated a short time previous to the lease of the 14th May, 1851, which is to the same parties, excepting W. H. Merritt, jun., who is substituted for the Hon. W. H. Merritt. This lease gave the Company all the surplus water and land upon the enlarged canal from the head of lock No. 2 to the head of lock No. 11, with some exceptions, and all the water that the race and aqueduct was capable of conveying.

By the old lease they had flowing through the race much less water, than by the new, (according to Mr. Keefer), they had the land, also the water which came through the wheel of a saw mill at levels Nos. 3 and 4. The new lease granted them a larger quantity through the race, and in addition the land and treble the amount of water upon eight levels of the new canal, for the same rent as formerly paid, notwithstanding the reports of the Engineers as to the expense of maintaining the race, and that the Hon. H. H. Killaly had stated the year before, that the rent was only about one-third of what others were paying, and not sufficient for maintenance of the race.

The term of this lease expired ten years ago. By its stipulation there is no provision for increase of rent. The Government has covenanted, in the event of non-

renewal of this lease, to pay for all raceways, erections, machinery, &c., that have been constructed by the Company or its tenants. The sub-lessees would, no doubt, prefer the Government to the Hydraulic Company as lessors, and in the event of non-renewal, if the Government agreed to supply them with water, would make no claim against the Water Power Company for expense of erections. In this case, the Government would require to pay only a very small sum to the Company, they (the Government) would assume control of the lands and water and obtain a fair equivalent for the expenditure necessary to supply these mills.

In the foregoing, with regard to the lease of the St. Catharines Water Power Company, I have not referred to the lease of Calvin Phelps, but in so far as the water flowing through the race-way is concerned. This lease is jointly responsible for all expenditure upon the race, and should bear equally the burden of its maintenance. Under the Welland Canal Company there appears originally to have been no lease for the water power to this mill, but when the sale was made to the Hydraulic Company he became their lessee. In a letter to the Directors of the Welland Canal Company, after the re-purchase, he says:—

"It was agreed on by and between Mr. Yates and myself, when I sold him land for hydraulic erections, that I should have a permanent lease for three runs of stones for \$150."

As he used only two runs and wished to put in an extra run, he begs to be informed what the Directors will charge. In 1837, a lease was given to Mr. O. Phelps for ten years, dating from 1832, for three runs, at a rental of \$150 per annum. In this lease there is a clause providing for an increase of rent at the expiration of the term of the lease.

In 1843, Mr. Calvin Phelps writes to the Secretary of the Board of Works stating he intends purchasing the mill owned by his father, and wishes to ascertain whether the mill race, aqueduct, &c., &c., conveying the water-power, from the mountain to this place, will be kept up and in repair. That the mill has five runs of stones. He inquires on what terms per year will the water be supplied to the mill, for three or five runs, and the race be kept up?

Mr. Killaly in his memorandum, written previous to the execution of the present lease, says of the "Merchant Grist Mill, Mr. C. Phelps, proprietor":—

"Mr. Phelps has a lease at £37 10s. per annum, but he has added, since the date of it, three runs of stones, and should now pay £77 10s. per annum."

On the 16th June, 1851, a lease was granted, which did not receive the authority of Council, to Calvin Phelps in which water power was granted for six runs of stones for £37 10s. per annum. In this lease no provision was made for an increase of rent, and it contains a clause not found in any other lease of water power upon the canals, viz:—

"This lease and everything herein contained shall revive and be revived for another like period of twenty-one years immediately thereafter, and so on from one period of twenty-one years to another, for four hundred and eighty-three years from the first day of January last past."

The lease to the Water Power Company provides for its cancellation by purchase of the property. Other leases, granted at the same time, provide for increase of rent and the lessees are charged double what this lessee is. This lease has no provision for cancelling, but the country is bound to renew it for four hundred and eighty-three years, and also bound to maintain the race and aqueduct for that period.

We find Mr. O. Phelps had a ten years lease for three runs of stones, the lease containing a clause providing for increase of rent. His son, by the letter above quoted, must have had his doubts (evidently aware of the expenses), if the Government would keep up the race, and likewise expected an addition to the rent. The value of the power was known in the Department to be £77 10s. per annum, other lessees were charged at this rate by leases granted at nearly the same time, yet this lease is granted for 483 years, binding the Government to keep up a race at some thousands of dollars annual loss, in consideration of only one-half the rent paid by

other leasees, the water to whom costs the country no more than the proportion of the original cost of the canal chargeable to water-power.

We have here, for no ostensible reason, a grant that may be called a deed of sale—leases generally do not exceed 99 years,—this is for a term of nearly 500 years, and may, therefore, be regarded as a deed of sale. The causes which operated in granting this exceptional lease, shown to be an annual loss to the country, at a less rent and of a character different from all other leases upon the canals, are not apparent. Considering the original cost and the annual expenditure for the maintenance of this raceway from which this lease and the Water Power Company derive the benefits, it is evident some immediate action should be taken.

In connection with these two leases it may be stated that three instruments were executed within a short period of each other.

The lease, to Young & Gould, St. Gabriel Water Power, 14th February, 1851, to the St. Catharines Water Power Co., 14th May, 1851, to Calvin Phelps, 16th June, 1851. The first has already been dealt with, the same contentions are applicable to the latter two. They have not, so far as I have been able to determine, received the authority or sanction of the Governor in Council, as provided by the Act 9 Vic. chap. 30, therefore *ultra vires*.

Although there is the recognition, of certain concessions, by the sufferance of agents and the receipt of rents, this fact could not override an Act of Parliament. It might be contended the Department has not the power to recognize these instruments, that if they are made the basis of new leases or renewals, it will be done upon an illegal document and the Department would have to accept the responsibility of their conditions by recommending them for the approval of Council.

With regard to the St. Catharines Water Power Company their present lease is a renewal of the original indenture from the Welland Canal Company, in which the rights and privileges granted by that Company to certain individuals, were granted by the Government to the assignees of these individuals, but in addition much larger concessions were made and for the same consideration.

It might be said an illegal instrument could not supplant a legal instrument, the rights of this Company under the original indenture from the Welland Canal Company would be the proper document where these rights can be found.

If the equitable rights, upon a question of values, are considered this is the only document where they are interpreted, if there was obtained by it an equivalent for \$500.00 per annum, since the date of the illegal document, 1851, the St. Catharines Water Power Company have either received, not received, or received more than value for this rental, it being unchanged, if the first and second there could be no objection by the Company to return to the original indenture, if the third the Government after 31 years of loss could not renew on the same terms for a further 21 years.

The character of this concession, its cost, both to the Welland Canal Company and the Government, are sufficiently detailed elsewhere.

In the lease to Calvin Phelps there is no allusion to the original indenture from the Welland Canal Company to Oliver Phelps. If we regard it in the light of a new lease, not only has it not received the sanction of Council, but it violates all the principles established by the Governor in Council at that date for the leasing of water-powers upon this Canal. If the Government decides to legalize this instrument it is at not a late date of its term it has some 450 years to run.

If this lease is considered a renewal of the original, from the Welland Canal Co., we may, in the same manner as stated above, return to it for rights and value. It grants three runs of stones at the same rent now paid for six, it contains a renewal clause, a term of ten years, and provisions for the increase of rent at the expiration of each term.

It might be a hardship to take advantage of omissions and irregularities if value had been paid, such has not been the case. The Engineer of the Canal states a short time prior to the date of the new lease that the value, according to the power and machinery in use, at that date, was £200 more than annually paid, or in say thirty years \$24,000 has been contributed not to encourage manufactures, but for the

personal benefit of middle men. In addition the Welland Canal Company and the Government have sustained, for nearly a half a century, heavy loss in supplying these leases with water.

The last relic of the Welland Canal Company which it is necessary to examine, is the flouring mill, at present the property of Mr. Lawson, formerly owned by Mr. George Keefer, sen. It is, what is called, a "free mill," water being perpetually supplied to it, free from rent, on account of land given the Government.

I find in the minutes of the meeting of the Directors of the Welland Canal Company, upon the 26th October, 1825, the following extract:—

"10th. A proposition having been made to the Directors by E. S. Beach, Esq., of Rochester, and George Keefer, Esq., of Thorold, that they would construct or cause to be constructed, a large and extensive flouring mill with at least four runs of stones, on the line of the Welland Canal, and have the said mill in readiness by the time the water is let into the canal:—Be it *resolved*, that the said General S. Beach and George Keefer, Esq., be allowed the privilege of a mill seat for the above purpose, provided they perform the said conditions."

This gift is a subject of Mr. McKenzie's 16th charge before the Select Committee of 1836, as follows:—

"That valuable mill sites have been given away without recompense, after stockholders had been induced to subscribe, by means of reports by the Board, that great wealth would be derived from the leasing of these mill sites."

Mr. McKenzie, in evidence before the Committee, was asked: "In what case has this been done?" To which he replied:—

"I allude first to the fact that Mr. George Keefer, the first President of the Canal, has enjoyed, for a number of years, the use of a valuable mill site, suitable for four run of stones, rent free, while other persons have been made to pay the full value for very inferior situations."

"The documents and extracts I now produce, namely, a resolution of the Board, 20th September, 1825, to appropriate land for mill sites; extracts from Mr. Merritt's letter to Mr. Wilkins, of Boston; a selection from Mr. Keefer's address to the public, in 1823; Mr. Clowes' opinion, and extract from the Director's Report, of August, 1825, show that every possible means was taken by Mr. Keefer, Mr. Merritt and other interested persons, to induce people at a distance to embark their capital in the canal, in order that they might profit by the hydraulics; respecting which, very extravagant expectations appear to have been formed; and the appended resolution of the Board, of the 3rd October, 1825; present: *only* Messrs. *Keefer, Merritt and Allan*, shows that one of the first acts of these interested parties was to present to one of themselves, a gift of a mill race, with water to grind, with four run of stones, as soon as the mill race could be dug, thirty miles in length, at the expense of the deceived stockholders and the Canadian public. On this subject I met with Mr. Yates' opinion in writing, which is as follows:—

"Mr. Yates is of opinion, that in the lease to Mr. Keefer it should embrace this reservation, that the Company may at any time re-take it by paying the amount of his outlay; and thinks it would give umbrage in any other way to the stockholders."

To this remark, Mr. McKenzie adds, "so it might, and with great reason too. No wonder the canal is out of funds."

The finding of the Committee upon this charge, was the following:—

"Upon charge No. 16, the only evidence is with respect to a mill site and water-power for four run of stones being given to Mr. George Keefer, senr., upon the condition that the mill should be finished and ready to go into operation immediately upon the water being let into the canal. As Mr. Keefer was necessarily to incur a great outlay which might have proved a total loss had any circumstance arisen to prevent the completion of the canal, which at that time was by no means certain, and as the great object of the directors was, by making a beginning of works of that description on the line of the canal, to encourage others, your committee are of opinion that the

propriety of this gift was questionable; but of this your honorable House and the public are equally capable of judging."

By the charter of the Welland Canal Company they had the power to appropriate land for the canal, mill sites, &c., and provision was made for arbitration as to values. The arbitrators met upon the 30th August, 1826. The preamble to this meeting reads thus:—

"It is however conceived to be the meaning of the Act, that any peculiar local advantages, such as facility of sale of town lots or other prominent advantages to an estate which may be a matter of commercial speculation, rather than of agricultural use, should be considered, as also such as may accrue to any contiguous estates entirely devoted to agriculture, that is to say, improving the health of the situation, increasing the supply of water, reclaiming wet and marshy lands, affording facilities of irrigation, establishing mills and other machinery in the vicinity, affording a more easy transport, in securing more ready sale and more convenient markets to the farmer, and many other benefits necessarily resulting in the completion of the canal.

"It is likewise conceived that the great public object in view, in the construction of the canal and the general rule in other countries, that private interests should yield to those of the public, should these so far operate as to supersede any claim for compensation on the ground of the owner's personal attachment to the particular part of the estate required and taken, it being deemed just and in accordance with the true spirit of all boards, for such objects as the present, not to award to any individual more than the intrinsic value of the property taken or damaged, considering, nevertheless, if important, the peculiar value of any lands to an estate generally, on the one hand, and the benefits accruing to the residue on the other."

The owners of lands from Thorold downwards, signed a deed submitting to arbitration, at which witnesses were examined as to the value of lands, among whom Mr. Keefer gave the following evidence in August, 1826, on behalf of the Company, as to the value of his land.

"Q. What is the number of your lot?—Lots 16 and 17, Thorold.

"Q. What quantity is required for canal?—20 or 30 acres.

"Q. How long have you been occupier of, and what price did you give for the premises?—32 years. Paid £106 N.Y. currency for 200 acres.

"Q. What is the value of your lot at present?—£10 per acre including buildings.

"Q. What did you value it at five or six years ago?—About £5."

States: "He apprehends no disadvantage from the canal. If he were to receive no remuneration for his land, other than the advantages which might accrue from the canal, would prefer canal rather than have route of canal changed. Petitioned for canal and generably favorable to it in every way. If he had no other than agricultural pursuits, would then think the benefit of canal equivalent to loss of soil, more so on his premises. Thinks some of his neighbors' property will be benefited as much as his."

Mr. Keefer does not appear to have signed the deed submitting to arbitration, nor was any award made by the arbitrators with reference to his property. For an adjacent property, some five acres, including canal and tow path, the increased value to property, from the canal running through it, was considered compensation, and £5 per acre for balance of land.

In the Welland Canal Company's Survey Book some 28 acres of Mr. Keefer's property is appropriated, in which the boundary includes the mill and canal property. On the 13th November, 1845, a deed to the Board of Works is made of some 29 acres, in which the eastern boundary of the property is changed. This deed runs thus:—

"Whereas the said George Keefer has heretofore permitted the Welland Canal Company to occupy, for the purposes of said canal, about 24 acres of the land hereinafter described, without having executed a conveyance therefor to the Welland Canal Company; and whereas the Board of Works have now the control of the Welland Canal and are desirous of receiving from the said George Keefer, his heirs and assigns forever, a deed of the said piece of land, which he has consented to execute in

consideration of the Board of Works allowing to him the said George Keefer, his heirs and assigns forever, the use of a sufficient quantity of water to work the flouring mill and all the machinery at present in the possession of and known as the property of the said George Keefer."

By this deed for the quantity of land, above named, and five acres additional, together with damages for raising the water, the sum of £350 were paid and a perpetual grant of water power for the mill as described.

The chief points in this transaction are:—that the minute of the Directors of the Company could not have bound the Government, or no deed of the water would have been required; that the value of this land, 28 acres, was settled by arbitration; it being occupied for nearly 20 years by Welland Canal Company and the Government, it is strange that some agreement should not have been had in all these years, with regard to this property. By the conditions of this deed, the Government paid over double what the other land owners had been awarded in 1826, together with water for four run of stones granted in perpetuity, or, by the prices established by the Government shortly afterwards, lower than the Welland Canal Company's tariff, at 6 per cent. represented a capitalized sum of \$3,500.

It is necessary the Government should have more definite documents drawn up with regard to this grant, as the present occupant claims he has a right to enough water to propel all the machinery he may place in the mill. The deed does not specify what machinery was in the mill at its date, and as time elapses that omission may cause dispute. The minutes of the Directors, in 1825, granted four run of stones. In a report by Mr. Francis Hall, C.E., upon the water power, in 1835, he states there are four run of stones in this mill. In a report by Mr. S. Power, Engineer of the canal, to the Secretary of the Board of Works, in March, 1846, four months after the date of this deed, he states there are four run of stones in this mill, and at the present time there are four run and machinery. This evidence is sufficient to settle any pretensions to a greater supply of water.

WELLAND CANAL LOAN COMPANY.

The last company to be referred to, on the principle of leasing the control of all the water at a number of locks and the alienation of Government land, is the Welland Canal Loan Company.

In 1847, the Mr. W. H. Merritt applied for land and water power from Lock Nos. 11 to 22, on behalf of a company which was to be formed for the purpose of developing manufactures along the line of the Canal. It was incorporated for the purpose of loaning money to individuals desirous of erecting mills or manufactories on the Welland Canal. In November, 1852, some 200 acres of land along the line of the canal, between St. Catharines and Thorold, were sold for £10 per acre by the Commissioner of Public Works.

Applications had been made, from 1847, down to date of lease, for the purchase of the surplus water from lock Nos. 11 to 22. The Commissioners of Public Works, in February, 1852, refused to grant the Company this concession, on the grounds that there would not be any greater stimulus given for the employment of the water-power, and that it would be highly inexpedient that the Government should cease to have the full and unrestricted control of this important work. A due regard for the public interest must prevent the Commissioner from agreeing to Mr. Merritt's proposal.

In April, 1855, the Company succeeded in obtaining this concession. Not having control of the land adjacent to the locks, and unwilling to expend money to utilize the surplus water upon the property purchased from the Government, they were unable to sub-lease the water-power. Falling behind in their payments upon the land, and the Government refusing to grant them land at the locks, and to strike out a clause providing for increase of rent, upon renewal of lease, they offered to surrender it.

The latter was agreed to, the Government in 1870 refunding them the sum of \$6,480, which had been paid in rent,—this amounted to the Government paying for over

three-quarters the lands purchased in 1852. The country also lost in revenue, what might have been leased, if the Government had not placed beyond their control the water-power.

With reference to this lease the Deputy-Commissioner of Public Works, Mr. Keefer, in a report, in 1863, says:—

"This," (the leasing), "was done, notwithstanding the very strong terms urged in my report of the 20th January, 1847, against the granting of such privileges to a company, and which, as the Engineer of the Canal at the time, I felt it my duty to oppose in the following terms:—

"I am aware that a proposition has been made to the Government on behalf of a company to be formed for that object, to buy out the whole of the water power; and if it can be satisfactorily proved that the power would sooner be brought into use without, at the same time, producing any inconvenience to the navigation, by committing it to the management of a company, it would undoubtedly be good policy to do so."

"But, the history of this canal teaches otherwise. And experience has proved that it is a dangerous thing to create an exclusive interest upon the canal, at variance with the interest of navigation. It was for this reason that the Welland Canal Company were at length compelled to buy out the (old) Hydraulic Company, which for several years enjoyed a right to all the surplus water of the canal.

"For the encouragement of individual enterprise, there is nothing to prevent the Government selling privileges, at least as cheap as a company could afford to sell them, and it is not unreasonable to suppose that capitalists would prefer taking a lease from the Government, direct, rather than from an intermediate party, whose interest it must be, to make large profits out of the sub-division of the power."

In regard to the manner in which the company fulfilled the objects of their charter, I will quote, by way of illustration, the following letters to the Department from Messrs. Gordon & McKay, manufacturers of cotton, deriving their water-power from the canal. Each of these letters is dated at Toronto, the first, 29th January, 1865, and reads:—

"According to promise, we now beg to bring under your notice the matter of the Welland Canal Loan Company, said company being chartered by Act 14 and 15 Victoria, and upon the 22nd April, 1851, did purchase of the Government certain lands, on the line of the Welland Canal, in all amounting in value to £2,113 11s. 3d., with the understanding and under the express condition (see deed) that they the parties therein named would form themselves into a Company with a capital of £50,000, to be loaned to parties desirous of erecting mills or manufactories on the Welland Canal."

Now, first, as to the land which they secured at a nominal price, we believe that further than first instalment nothing has been paid; in proof of this we beg to refer you to a report of the Superintendent of the Welland Canal, 1864, wherein he says that the arrears in land sold Benson and others, in behalf of the Welland Canal Loan Company, have been accumulating for over a period of ten years, and during which time no payments have been made, &c., &c.

Now, the result of this nominal ownership by Benson and others of those valuable lands, is 1st, the total withdrawal of said lands from the market except upon terms and conditions that parties willing to buy and pay cannot submit to (and will not. 2nd, the known fact of such an irresponsible monopoly of all the available lands in that neighborhood, prevents capitalists from building mills or manufactories in that neighborhood. We could give two or three instances where large capitalists have been driven from investing and taking advantage of the large surplus water power, from impossibility of obtaining room for cottages: but note our own case. We employ about a hundred operatives, have invested over \$80,000 in a cotton mill, and offered this Company \$7,000 in cash for a few acres, and were met with an indignant refusal, hence we are cramped for space for a few cottages, having to build on road reserves, &c.; although we offered them more than double what they only promised to pay for it, certainly much more than its worth, it may be said they have

a right to charge their own price for the lands. We admit this so long as they comply with the terms of their charter. Next, as to their charter empowering them to loan moneys, &c., this is only a farce or a cloak to obtain and retain the lands at a nominal figure. They neither loaned or had it to loan, instead of encouraging mills, &c., they have been a curse to that locality. To give them an opportunity to loan we addressed them the accompanying letter to which we have the short reply that it would be submitted to the Board at its next meeting. We can trace no evidence of there having been a meeting for the last ten years. The truth is, the whole affair has been a speculative job, and we believe that in law and equity they have forfeited all claim to these lands, and we pray that the Government will submit the case to the Law Officers of the Crown, repossess the lands and put the same up to competition. We have had their charter, deed, &c., before our own solicitors, and they agree with above views. We have only stated the leading features in the case, but we trust enough to satisfy the Government to order an investigation, and we beg further to add that we have only stated what we are prepared to prove before any court or tribunal.

The second letter is dated 23rd May, 1865, three months after the date of the first, which reads:—

"We would beg to state in addition to the memorandum, that our chief difficulty with the Company has been the impossibility of obtaining any building land for our operatives, now numbering over (100) one hundred, and now scattered over a radius of two miles. We at various times made them overtures to purchase a small quantity for building purposes, the last offer made them was (\$7,000) seven thousand dollars, double its first value, and were simply met by a refusal to sell. (This was for a small portion of that land bought of the Government at £10 per acre, or agreed to be bought at that, and which has never been paid for, nor any of the conditions of sale complied with. Had the conditions been enforced, that property to-day would not be occupied by a few squatters.

"Next, we complain and appeal to the Government on public grounds. We believe it unfair and unjust to the country that an irresponsible Company of two or three speculators should, preremptorily and at will, be permitted to lock up the public domain to the detriment of all public interests and private enterprise, refusing to pay, sell, or let. We now leave the matter in your hands, believing the Government have the power as well as the desire to do justly in the premises."

In a report upon the Machine Canal, the history and the results arising from a water-power company situated upon that canal are given. This concludes a statement of all the companies that have existed upon the canals; the facts connected with which must render obvious the inexpediency and direct loss occasioned by the alienation from the control of the Government, of the surplus land and water along the line of the canals. These Companies having been able to obtain concessions private individuals were unable to acquire, never accomplished the objects they set forth, but merely acted as middlemen, receiving, for their personal benefit, the difference between the amount paid the Government and that paid them by sub-lessees, without rendering any adequate return.

Action to be taken upon present leases.

As the greater proportion of the leases have passed the period of renewal, some action will shortly be taken. The quantity of water used, determined by the measurement of wheels, apertures, &c., must necessarily be approximate. This approximate calculation, together with the class of water-motors in use, and other data, which will show how far the power is being actually utilized, is given in an appendix.

The leases may be divided into three classes, viz:—

1st. Leases to private individuals who use little water above what is leased, and pay a fair rent according to prices determined by Order in Council.

2nd. Leases to private individuals which have fallen into the hands of manufacturing companies, who use a much larger quantity of water than leased, and pay nothing for this excess.

3rd. Companies or individuals who have control of all the land and water at several locks without any definite amount of power specified, and pay little for the concession.

By inspection of the appendix the first two classes can be readily determined, in renewals of leases they should pay for the power used, and be compelled to put in good water wheels. The third class may be especially referred to, on account of the great inequality between the price paid and the power used.

We have first, the St. Catharines Water Power Company. The approximate capacity of discharge from the water wheels would give a power of some 1,000 horses, at 75 per cent. for useful effect. The principle affecting the leasing of water, quantity of water, or amount of power, to a run of stones, and other facts connected therewith, having been stated in a report upon the Lachine Canal, it is unnecessary to refer again to what may be considered settled questions.

Of the approximate amount of power used by the St. Catharines Water Power Company, 532 horse power is utilized upon the hydraulic races. The whole of this power is not supplied from the race maintained by the Government, as the water in the lower race, upon which the flouring mills of Mr. Norris are situated, is supplemented by a supply from the level of the canal above his race. Allow 400 horse power, as the amount, to be effectually utilized, between the level of the upper race and level No. 2 of the Canal, by the St. Catharines Water Power Company, we have this amount as the proportion to be charged for the maintenance of the raceway. Mr. Neelon, who has acquired the Phelps' lease, notwithstanding the heavy expenditure required to maintain the race, has two antiquated overshot wheels which use double the water he is entitled to by the terms of his lease. He is using some 130 horse-power, while his lease entitles him to 60 horse-power. His lease grants the right to use six runs of stones; there are seven in his mill. He has also sub-leased 10 horse-power to Mr. Abell without any right or title, as the maximum of the water, flowing through, he is entitled to, is to drive six runs of stones, under a head of 22 feet. The rent received from this sub-lease belongs to the Government, and action might be brought to recover the amount received from it.

There is, in addition to 400 horse-power, chargeable to the St. Catharines Water Power Company, 60 horse-power leased to C. Phelps, (now Neelon), contributing to the maintenance of the raceway. The cost of maintaining the race has been previously shown, but upon the cancelling or renewal of these leases we have another condition of things. The wooden aqueduct, which was expensive to maintain, has been lately replaced by an aqueduct with stone foundation and iron superstructure, with a wooden box or flume for carrying the water, at a cost of some \$12,000; this aqueduct should, with the interest upon its first cost, together with painting, repairs, &c., be charged at least 10 per cent., or \$1,200 per year. In round numbers \$4,000 was paid for the land, which at 6 per cent. would be \$240 per annum. The supply weirs and head gates costing, say \$3,000, at 10 per cent. or \$300 per annum, and taking the small estimate of the raceway at \$5,000, which, for the great expense of its maintenance, should give at least 20 per cent., or \$1,000 per annum, we have, therefore, an annual cost to the country, for purely hydraulic purposes, without the slightest connection with navigation, a total amount of \$2,740. Taking \$200 as the proportion of rent paid by the Hydraulic Company, chargeable to the raceway, and the rent of \$150 from Phelps' lease, would give a total of \$350, or an annual loss to the country of \$2,390. It remains to be decided whether these leases are to be maintained at this direct yearly loss, and, in addition, nothing paid for the water.

I should recommend that the lease to the St. Catharines Water Power Company be cancelled, that the water, the upper race will discharge, be leased to Mr. Neelon or other parties, and the water flowing in the second race be charged to the mills situated between it and the lower race of Mr. Norris,—that the water flowing in the lower race be charged to Mr. Norris who could lease directly from the Government,—that

the mill sites and water-powers now sub-leased, upon eight levels of the canal, by the St. Catharine's Water-Power Company, be leased directly by the Government under a new system, if such be adopted.

With regard to the Phelps' lease, such action should be taken as that it should bear its proportion of the cost of the raceway, and pay the value of the power used, and that this peculiar lease of nearly 500 years should, if possible, be annulled.

Messrs. Gordon and McKay have leased to them the water at three locks. In another report I have dealt with the value of the power in the manufacture of cotton. Their power is costing them slightly over one dollar (\$1) per horse power.

John Riordon has leased the water from locks Nos. 17 to 21, and is engaged in the manufacture of paper. He obtains power at some 50 cents per horse power,—this value includes mill site.

The prices paid are extremely low and are equivalent to a protection in favor of the mills upon the canals, against those situated elsewhere, requiring a large sum of money to be expended in obtaining power.

The Lincoln paper mills, manufacturing paper, are situated upon the hydraulic race, near its exit from the canal. This mill has no lease, nor has paid any rent since its erection. In 1878, Mr. S. Neelon made application for damming the hydraulic race and for the use of the water flowing through the raceway. This was granted upon certain conditions, a lease was drawn up but not submitted to Council and remains unsigned. The rent was to be \$100 per annum, as this mill is using some 143 horse-power, this rent would give some 70 cents per horse-power per annum. This price was, no doubt, based upon the low prices fixed for the concession to Messrs. Gordon & McKay, and Mr. Riordon. It will be seen by reference to Appendix, that the Welland Vale Manufacturing Company, the saw mill of Mcleary & McLean, the saw mill of John McDonough, the flour mills of Howland & Co., the Thorold Wood Pulp Co., and the cement mill of John Battle, are using much more power than leased. Upon the main line of the canal, there are a number of good water-wheels of the turbine class, and a number that are great wasters of power. There are six wooden overshot wheels which should be replaced by a more modern type. The tail races, in many instances, have not sufficient depth underneath the wheels, thereby, preventing the free discharge of the water and causing loss of power. There are a number of saw mills on this canal, which, if the rents were placed sufficiently high, would probably give place to other manufactories of more benefit to the community.

The mills at Dunnville, upon the Grand River and upon the feeder, call for special attention. Some of those at Dunnville have bad flumes, with the most inferior description of water wheels, which is unfair to others in the same place, having economical turbines,—this is especially felt when the water supply is low.

Proposed Scheme for Enlarged Canal.

The full power of the enlarged canal cannot be utilized until the completion of the new aqueduct. The present aqueduct has, at some periods, a current of three feet per second, not caused by the water flowing to the mills, but by the fluctuations of Lake Erie. The head gates not being in position, at the head of the canal there is no standard level of the upper reach maintained. This makes the reach, what may be called, a tidal arm of the lake, rising, and falling, according to the direction of the winds. The section of the aqueduct being small, any increased supply for water-power combined with the current from the lake might be prejudicial to navigation. An extended leasing of the water-power upon this canal must be postponed until the new aqueduct is completed.

The old, and new lines of canal, provide two channels by which the fall, between Lake Erie level and the level of Lake Ontario, can be utilized for power. There are at present some 4,000 H. P. used upon the old canal, the question arises whether the water-powers be confined to the old canal, or the increased water-power furnished by the enlargement distributed along the new canal. The new canal has many advantageous positions for mill sites, but it is evident there would be no water

powers, if water, for power, is not sent down it. I should recommend that the water-powers be confined to the old canal.

If this canal, in the future, carries the productions tributary to it, there will be a heavy traffic in vessels of large tonnage. The new line is exposed, along its whole distance from the summit of Lake Ontario, to the wind; a current of any great velocity would be disadvantageous, taken in conjunction with the sweep of the wind that vessels are exposed to. If there were no other positions in which the water-power could be utilized, this objection would not be sufficient to counterbalance the increased revenue from the power furnished by the enlargement, still when any disturbing influence upon this line of navigation could be obviated, without loss of revenue, it becomes preferable to confine the water-powers to the line of the old canal.

It is proposed to close the old canal, to navigation, and convert it into a purely water-power canal, which would give sufficient mill sites to use the whole power furnished by the enlargement. The numerous basins now used to prevent the fluctuations of the levels by lockages, would be available for mill sites. This line is advantageously situated, with regard to railway communication, which could be extended to nearly every mill. The only lock requiring to be maintained would be lock No. 2, which would allow vessels to ascend to the St. Catharines level from the basin at Port Dalhousie. Lock No. 1 of the old canal would be dispensed with, and its position used as a mill site. Vessels could also descend to Thorold without increased expense, as the men required to regulate the supply of water at the head gates, could lock down the few crafts that might descend to Thorold. Between Thorold and St. Catharines the traffic to the mills by vessel is very small, and would not justify the Government in incurring the large expenditure, for maintenance, and repairs, upon a now useless line of navigation, when railway communication would answer every purpose. The masonry of the locks and weirs is in a bad condition, and must entail an increasing expenditure. There is a great length of floating tow-paths, expensive to maintain, which would be dispensed with. The present wooden swing bridges would be replaced by permanent structures of iron. The water-power could then be dealt with, apart from navigation, upon scientific principles, its full development be advantageous to the district, and become a large addition to the revenue of the country, which would tend to lessen the cost of maintaining a canal yearly doing less business.

The present annual cost of maintenance, and repairs, of the old canal from Allandale to Lake Ontario is some \$17,000 in wages to men employed. In the year ending June, 1881, the cost of maintenance and repairs was some \$60,000, in 1882, some \$50,000. We might assume an annual saving of \$75,000, in abandoning this canal, which, as will be subsequently shown, will never be required for navigable purposes. The enlarged canal down the mountain will be used purely for navigation, and unaffected by any disturbing influence, caused by supplying water to mills, along its route, which, as has been shown in previous reports, might arise without careful management. Any detailed plan for utilizing the power is unnecessary, until the canal is completed, and it is decided whether the water-power be confined to the old canal.

Some 900 cubic feet of water, per second, can be safely used for hydraulic purposes without causing too great an hydraulic gradient, or current of a velocity that would be injurious to navigation. When the canal is fully completed and its characteristics studied, a greater supply might be permissible, the current would be wholly confined to the summit level where it could not be objectionable.

Between the summit level and Lake Ontario, there is a fall of some 325 feet, at mean water level, which would give, with a supply of 900 cubic feet per second, some 33,150 horse-power, of which 16,000 horse-power might be effectually utilized and return a revenue, if all leased. The value of power upon this canal was set at \$10 per horse-power by the Welland Canal Company in 1829. Some 20 years after, by Order in Council, 27th October, 1849, it was set by the Government at \$6 per horse-power for the first ten horse-powers, and \$5 for each subsequent horse-power. Ground

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rent for mill sites was \$20 per annum, the water was conducted from the canal to the mills by the Government, and the interest on the cost charged to lessees. These charges have been maintained, to private individuals, with some exceptions.

Whatever might be said for a low priced power before a protective tariff was adopted, it is evident that under such a policy all should fare alike. If the tariff is sufficient, low priced power is a double protection and an illegitimate profit from the taxes of the people. Upon the canal, from Allanburgh to Lake Ontario, power should be worth, including mill sites, \$12 per horse-power per annum. I have previously taken 16,000 horse-powers as capable of being utilized, reducing this to 10,000 horse-power, including the power now used by the mills, on the line of canal, it would give a revenue of \$120,000 per annum, which, with the saving caused by the abandonment of the old canal, would be a large item, in the event of the tolls being reduced or abolished, towards meeting the expense of maintenance and repairs upon the canal.

The supply weir at the head of the hydraulic race is capable of discharging double the quantity of water, it, at present, discharges. It is evident, that purely hydraulic expenditure, should be covered by utilizing the full power of the race. From levels Nos. 11 to 2, the fall is about 112 feet. This race could be dammed above the present aqueduct and furnish an additional mill power; at the aqueduct, a fall of forty feet could be obtained, with available sites for mills—this fall with a small quantity of water would give a large power. From this race there might be obtained some 1,000 horse-power, which would give great manufacturing facilities near the city of St. Catharines and a return for the expenditure incurred.

Upon this canal, as well as others, there has been made, apart from the hydraulic race, which was especially for mill power, additional expenditure for furnishing water to mills; it is unnecessary, as done with the Lachine Canal, to particularize this expenditure, as the principle has been fully established. I may mention the great outlay at Port Colborne, for admitting the water from Lake Erie, which was unnecessary, to supply all that was required, to meet the consumption for a canal for navigable purposes. Along the line of canal, many other expenditures, purely for mill purposes, might be cited.

I have dealt with the main line of canal, but, connected with it, there is the water power obtained by the dam upon the Grand River at Dunnville. Since the adoption of Lake Erie level, the feeder not being required for the supply of the canal, except in the case of slides in the deep cut interrupting Lake Erie level, nearly the whole of the water is available for power, as the navigation from Port Maitland is of little consequence. It was the intention of the Government, to construct a hydraulic canal, to carry the water to the town of Welland from the feeder, and utilize the fall between it and the Chippewa Creek for power. As the head, at that place, is greater than at Dunnville, it is obvious it would give increased power to send down the feeder as great a quantity of water as possible, the mills at Dunnville should then be required to strictly economise the water, as well as the mills upon the feeder, which now waste water under a low head, and with the most rude description of wheel. If this water is to be conveyed to Welland it would be well, that the leases of the two saw mills upon the feeder were cancelled, as they waste a large amount of water. The total power which the water discharged, through the wheels at Dunnville and upon the feeder, would give is some 295 horse-power, or at a rent of \$10, would yield \$2,950. The power afforded by this dam is susceptible of giving a much larger revenue by practical and economical management.

Upon the main canal and at Dunnville there could be leased hydraulic power sufficient to realize a revenue of \$125,000 per annum, in addition to a saving, by abandonment of the old canal, of \$75,000, or a total of \$200,000 per annum.

A comparison of the rent paid by the lessees upon this canal, at present, with the amount that should be obtained by the Government for water used, shows a great disproportion, viz:—

	Proposed Rent.	Present Rent.
St. Catharines Water Power Company.....	\$12,000.00	\$ 500.00
Lessees on main line of canal.....	36,000.00	3,747.67
" at Dunnville and Feeder.....	3,000.00	1,284.00
Totals.....	\$51,000.00	\$5,531.67

An increased revenue of.....\$45,500.00.

Effect of the Competition of Rival Routes upon the Future Trade of the Enlarged Welland Canal.

Upon the recommendation, previously made, to close the old line of the Welland Canal, from Thorold to Port Dalhousie, and convert it into a water power canal, it was stated this portion of the canal was useless so far as required for navigable purposes. In support of this proposition, reference may be made, to some general remarks made in a report of April 29th, 1882, upon the transportation question and the effects of the competition of rival routes upon our canal system. In addition, I may state with particular application to the Welland Canal, that the traffic is year by year diminishing, and the expense of maintenance and repairs increasing. That the increase of traffic, on account of the enlargement, will be in any way commensurate with the expenditure, is highly improbable, at least for years to come.

The direct rival to the Welland Canal, for the transportation of cereals, which are shipped at various western ports, for tide water, is Buffalo, and the lines of railway and Erie Canal centering there. From Chicago, to Buffalo and Port Colborne is nearly the same distance. Buffalo has every advantage for transshipment and storage of grain. The inner harbour, or river, is lined with elevators, coal trestles and pockets. There is every improvement necessary for the transfer and storage of cereals, and for the loading of vessels with return cargoes, with celerity and dispatch. There are thirty-six elevators, costing some \$6,000,000, with a storage capacity of 8,000,000 bushels and a daily transfer capacity of 3,200,000 bushels. Three of the elevators are owned by railway corporations. Mineral roads are also making Buffalo a shipping point; the coal exports westward are increasing yearly, which, with salt and other merchandise, insure vessels a return cargo at, sometimes, more remunerative rates than the eastward freights.

In contradistinction to this, the enlarged Welland Canal has inadequate facilities for lightening and transporting grain from Port Colborne to Port Dalhousie. At the present terminal point of the large lake craft, the elevating, storage, and transfer capacity are insufficient to accommodate any considerable traffic, the expense of demurrage so great that grain, in any quantity, could not be diverted from Buffalo to this point, and in addition it cannot provide return freights.

To demonstrate the advantages Buffalo possesses in the way of loading and clearance of vessels; while in Buffalo, statements were made which I had not the opportunity to substantiate, and cannot answer for their correctness. At one coal trestles they are able to load daily, into vessels, 4,700 tons, and unload from cars of the 2,700 tons. The "Kershaw" came into port with 1,300 tons, at 10 a.m., and cleared at 12 p.m., with the same quantity of coal. The steam barge "Hiawatha" with a tow of two vessels, some 4,000 tons in all, were unloaded and cleared within twenty-four hours. The steam barge "Palmer" arrived light at 10 a.m., and cleared with 1,300 tons of coal at 12 a.m.

Mr. Thurston, Secretary of the Buffalo Board of Trade, states:—

"There are four large steamboat lines plying regularly between this port and ports on Lakes Erie, Huron, Superior and Michigan. These combined fleets number fifty-two first-class steamers, having a capacity varying from 1,750 tons to 2,200 tons. With the completion of the Government improvements in the Detroit River, which are well advanced, the appearance of 2,500 ton vessels in Buffalo harbor will not be an unusual sight."

There are numerous small propeller lines, steam barges with consorts, and sailing vessels of large tonnage. As an example of the capacity of a propeller and tow, the "J. B. Lyon" and two schooners carry 224,000 bushels of grain. The "Ballantyne," with one schooner, 115,000 bushels. The "W. T. Graves," with two schooners, 190,000 bushels. The facility afforded vessels at Buffalo, and the large vessels able to ply between it and western ports, account for the great increase of imports of grain at that port, and the diminishing quantity arriving at Port Colborne, which is shown by the comparative statement, by decades, of the quantity of the principal cereals exported to Europe, viz.: Wheat, including flour reduced to bushels, and corn received by lake at Buffalo, passed through the Welland, and that shipped from Buffalo by Erie Canal.

COMPARATIVE TABLE.

	Wheat and Corn received by Lake at Buffalo, including Flour reduced to Bushels.	Wheat and Corn passed through Welland Canal, including Flour reduced to Bushels.	Wheat and Corn, including Flour reduced to Bushels, Shipped from Buffalo by Erie Canal.
1850.....	11,789,920	5,205,279	10,085,733
1860.....	35,500,537	16,036,179	25,079,376
1870.....	37,378,805	17,000,339	22,901,760
1880.....	109,374,201	14,450,783	70,407,278
1881.....	58,186,400	8,377,311	29,224,508

From this table it is seen that the proportion moved through the Welland Canal of the receipts by lake at Buffalo, was, in 1850, 0.44; in 1860, 0.45; in 1870, 0.45; in 1880, 0.13; in 1881, 0.14. That the quantity moved through the Welland Canal was in proportion to the quantity shipped at Buffalo by Erie Canal, in 1850, 0.49; in 1860, 0.64; in 1870, 0.74; in 1880, 0.20; in 1881, 0.29.

In 1870 the tolls were reduced upon the Erie Canal. From 1875 there has been a constant decrease through the Welland Canal, as compared with 1870. By these percentages, it is seen, that the Erie Canal has well maintained its proportions of the lake receipts at Buffalo; that the Welland Canal movement has fallen from 0.45 in 1870, to 0.13 in 1880, and to 0.14 in 1881 of the lake receipts, and from 0.74 in 1870, to 0.20 in 1880, and 0.29 in 1881 of the quantity shipped by Erie Canal from Buffalo.

The decrease of the cost of transit, reduction of tolls and increased cargoes of barges, upon the Erie Canal, are shown by the following table of the cost of transportation, per ton, from Buffalo to Albany.

DOWN FREIGHT, PER TON, BUFFALO TO ALBANY.

	Freight.	Tolls.	Total.	Average Cargo of Boats.
	\$ cts.	\$ cts.	\$ cts.	Tons.
1850.....	2 56	2 92	5 48	76
1860.....	2 47	1 41	3 88	140
1870.....	2 01	1 05	3 06	181
1875.....	1 43	0 70	2 13	204
1877.....	1 67	0 37	1 94	214
1878.....	1 11	0 37	1 49	216
1879.....	1 49	0 37	1 86	197
1880.....	1 35	0 35	1 70	215
1881.....				

If the tolls, upon eastward freight, are abolished on the Erie Canal, it will amount to nearly 20 per cent. of the cost of transport from Buffalo to Albany. The railways to tide water from Buffalo are becoming each year greater competitors to the Welland and Erie Canals. The railways have their own propellers and elevators. In 1860, the Erie Canal carried a much larger quantity of vegetable food to tide-water than the railways; in 1870, this proportion had fallen to 0.423; in 1880, to 0.333, and in 1881, to 0.183; the great falling off in 1881 was caused by the rupture, of the agreement, between the railway lines to the sea-board, and the consequent low freight rates.

Besides the competition of Buffalo, a rival route to the Welland Canal is being rapidly developed within Canadian territory, by vessels from Chicago to Ports on Georgian Bay, thence by railway to Lake Ontario, and by barges or railway to tide water, according to the option of the shipper. It is expected some four millions of bushels of grain will be attracted to this route during the season of navigation.

If these expectations are fulfilled, it will become a direct annual reduction of four million bushels of grain from the traffic of the Welland Canal, and when other lines of railway from Georgian Bay eastward are constructed, this route may prove a serious competitor for the constantly diminishing trade of this canal.

During this summer, the cost of transportation from Chicago to Midland ruled from $1\frac{1}{2}$ to $2\frac{1}{2}$ cents per bushel, from Midland to Port Hope $2\frac{1}{2}$ cents, and to Belleville $3\frac{1}{2}$ cents. Cost of elevating and shipping in barges, three quarter cent per bushel. These rates would place grain from Chicago, in vessels at Port Hope, at from $4\frac{1}{2}$ to $5\frac{1}{2}$ cents, and in barges at Belleville, at from $5\frac{1}{2}$ to $6\frac{1}{2}$ cents per bushel. In addition, to railways from Georgian Bay, a rival water-way is being constructed, by the Trent Valley route which would afford a barge navigation from Georgian Bay to tide-water. This canal, if carried out, and meets the expectations of the promoters of it, will seriously interfere with the traffic of the Welland Canal.

From these facts, it is evident, the enlarged Welland Canal will have as severe an opposition as the old Welland Canal has had. It is stated concerning the Erie Canal, that:—

“The capacity of the canal has never been fully tested, and the shipments in 1880, which were the largest ever reported, reached 72,000,000 bushels and were forwarded with as little effort as 35,000,000 in 1878.”

The old Welland Canal, of a larger capacity, never did a business approaching to this amount, and it may, therefore, be presumed that the enlarged Welland Canal is sufficient to accommodate all the traffic that will ever pass through it, and that closing the old canal to navigation, and converting it into a water-power canal would be an economic action, increasing the revenue from this work, thereby lessening the taxation required for the interest upon the outlay, and what will become an additional taxation, the maintenance and repairs. It is evident that so far as individual enterprise is concerned, it will be an indefinite period before accommodation will be afforded, sufficient to divert to this route any considerable trade. If the Government, as adjuncts to the canal system, add sufficient elevating and storage capacity to lighten, and load, a large class of vessels at Port Colborne and Port Dalhousie, with adequate elevating and storage capacity at the terminal point of lake and barge navigation, to prevent demurrage, a considerable portion of western cereals might be attracted through the Welland Canal.

General Concluding Remarks.

Having concluded this series of Reports, a general summary may be given of facts and deductions, incident to this examination.

In the following tables, and those appended to each Report, the amount of power in use, and the discharge of water, are approximations.

Many water-wheels are in such a position that it was impossible to make accurate measurements, therefore, information had to be obtained from owners or foremen of mills. To determine the discharge of water from apertures, requires a close inspection.

tion of the description of orifices to be measured, and where the measurements should be made. Parties from whom information is obtained have not, generally, the acquaintance with this subject necessary for furnishing data, without a percentage of error.

In mills having a number of wheels, only a proportion of them may be running at the same time, this proportion it is impossible to obtain by a cursory inspection. It also might be to the interest of lessees to underestimate the water consumed, any information obtained from them might be open to doubt, therefore, the only practical method is to estimate the power there is the opportunity of using.

The power, as stated in tables, is not to be taken as the amount necessary to impel the machinery in the mills where there are water-wheels of an inferior description, but the power their discharge would give if turbines of a percentage of 75 per cent. for useful effect, were used.

Many wheels are so inefficient that only one-half the power is obtained, as stated in tables. Others will give a greater power than stated if we take the assertions of the manufacturers of turbines, who generally exaggerate the power they will yield.

If the recommendation is accepted, that lessees be charged for power at 75 per cent. for useful effect, all wheels giving a larger percentage will be profit and gain to them. This is illustrated by the following table, comparing the power given in the appended tables, with the power manufacturers state their wheels will provide.

Lessees.	No.	Name of Turbine.	Power as stated in Tables appended to Reports.	Power as asserted by the Manufacturers of Turbines.
			H.P.	H.P.
Toronto Paper Manufacturing Co.....	4	New American....	410	438
King & Dolan, Cotton Mill.....	3	Victor.....	280	310
Buntin & Co., Paper Mill.....	2	Hercules.....	507	589
do do.....	7	Leffel.....		
John Riordon do.....	2	Risdon.....	873	998
do do.....	5	Leffel.....		
do do.....	2	American.....		
Totals.....			2,970	2,335

With Water-Power Companies, lessees are charged for the water consumed, consequently, it is to the interest of the latter to obtain water-wheels of the highest efficiency. It is the constant efforts of makers of wheels to increase their percentage of useful effect, and large amounts of money are expended in experiments; the rivalry between the makers and the increasing value of water-power in the United States, have resulted in the construction of economical hydraulic motors, and at a cost which places them within the reach of mill owners.

On the Canadian Canals the rates charged for power are so low, and the consumption of water so extravagant, that there is no object, in many instances, in obtaining good wheels. If mill-owners are allowed to draw sufficient water to propel their machinery with poor wheels which will cost, say, one-fourth that of good ones, it is certain they will never expend the other three-quarters to replace them with better.

The following table illustrates the number of wheels upon the canals, and the numbers of these efficient and inefficient.

	Number of Wheels.	Efficient Wheels.	Inefficient Wheels.	Percentage of Inferior Wheels.
Lachine Canal—				
Basin No. 2.....	53	8	45	0.85
St. Gabriel.....	26	20	6	0.23
Côte St. Paul.....	17	6	11	0.65
Beauharnois Canal.....	34	28	6	0.18
Cornwall Canal.....	24	14	10	0.42
Williamsburgh Canals.....	28	8	20	0.71
Welland Canal—				
Government Lessees.....	55	33	22	0.40
St. Catharines Water Power Co.....	31	13	18	0.58
Dunville and Feeder.....	16	3	13	0.81
Totals.....	284	133	151	0.52

This table shows that some 50 per cent. of the water-wheels in operation on the canals should not be permitted upon any line of navigation. Under a water-power Company the cost of power would prevent an exhibit like that at Basin No. 2, Montreal, where 85 per cent. of the wheels are of a description unworthy of a primitive saw-mill in the backwoods of Canada. If the old Lachine Canal had been converted into a mill-race by large and important industries, supporting a number of work people, the immediate community would have been benefited. On the contrary, the condition of the Lachine Canal before its enlargement, as related in the report upon that canal, was caused not by power obtained, not by increased production nor the support of a large labouring population, but in a great measure by absolute waste of water through inefficient wheels and loss of head.

There is this anomaly that at Valleyfield, Beauharnois Canal, where the waste of water cannot affect navigation, there are thirty wheels, the power from which will give employment to 1,600 operatives; only two of them are objectionable. At Basin No. 2 there are fifty-three wheels, 85 per cent. of which should not be permitted on the canal, giving employment to some 580 people. The waste of power in impelling twenty runs of stones in three flour mills upon this Basin, employing some 40 people, would give employment to some 600 people in the manufacture of cotton.

Extremes meet. At Basin No. 2, in the very heart of the commercial metropolis of Canada, the head of ocean navigation and the foot of canal navigation, and at Dunnville, a small town of western Ontario, distant from the main line of the Welland Canal and the important centres of commerce, have, respectively, the largest percentage of inferior water-wheels upon the canals.

There is only some \$1,000 increase in revenue from 1851 to 1882, although there is a large increase in the use of power and machinery impelled. Manufacturers of the same products are charged at different rates for their power, a circumstance from which trouble will arise.

Some of the leases contain a clause with regard to rent at the expiration of the renewal term of 21 years, which reads:—"At the rent that may then be paid by our lessees of hydraulic privileges on the Welland or other Provincial Canals, or at such other rate as we may think proper, not exceeding the highest rent paid on our said Welland or other Canals, not less than the rate per run of stones herein mentioned to be paid during the term granted."

A manufacturer at Basin No. 2, Lachine Canal, where the highest price is paid for power, might say, place me on an equality with my competitors upon the Welland and other canals; reduce the rent upon my power to the average rate upon the other canals; I have paid a much larger rental for a longer period; it is unfair that a later lessee, who has contributed little to the revenue of the country, in comparison with thirty years of this lease, should only pay one-tenth of what I have been paying for a number of years.

The number of leases, which have passed their first term and require renewal, is so great, together with the changed condition from the enlargement of the canals, will necessitate some radical measure and a fixed value for the power on the various canals.

In setting the value of power for renewals of leases or for new leases, it might be well for the Government to cancel some of them, under the conditions of lease. For instance, at Basin No. 2, Lachine Canal, I find that one of the lessees, by the Inland Revenue Report for 1881, is some \$34,000 in arrears. The Government is required to pay the value of erections, but if this arrearage was made a set-off, the property could be acquired at little expenditure. This property might, then, be put up at auction, at an upset price of say 6 per cent. interest, as rental on 80 cents for each square foot, for mill site, and \$12.00 per horse-power as rental value of power; if it were sold at this price, or in excess, it is evident this would be a fair index to the rental to be established for the next 21 years, or whatever period was determined for, upon Basin No. 2.

The same method could be applied to the other canals. Mill sites could be put up at auction upon the Beauharnois, Cornwall and Williamsburgh Canals at an upset price, determined upon for mill sites, and \$10.00 per horse-power for power. On the Welland Canal the upset price for power might be fixed at \$12.00 per horse-power, and at Dunnville \$10.00 per horse-power. By such a method, a fair means would be employed to fix the price for renewed leases.

It would be well that the Government should also expropriate the land and water power which has been alienated from its control by deeds or grants in perpetuity,—an objectionable feature upon the canals. The determination of their value would lead to evidence by experts, which would be another method of determining the value of power in the particular localities in which these grants have been made.

If uniformity of rates upon all of the canals were desired, the upset price for power, not including mill sites, might be placed at \$10.00 per horse-power per annum, which, if compared with steam power, would give the following difference as to cost:—

STEAM-POWER.—Engines working 10 hours per day, for 300 days, coal \$5 per ton, at 3lbs. per horse-power per hour, engineer's and firemen's wages, oil, &c., interest and depreciation in plant included—per horse power per annum.....	\$ 50 00
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WATER-POWER at a rental of \$10.00 per horse-power, including interest and depreciation in turbines, pen stocks, flumes, &c.,—per horse-power per annum.....	16 00
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SUMMARY OF MANUFACTURES ON THE ST. LAWRENCE AND WELLAND CANALS.

	Hands Employed.
<i>Manufacture of Silk.</i> —Silk Fabrics and Thread :	
1 Mill ; 2000 Spindles.....	50
<i>Manufactures of Wood.</i> —Consisting of ship building and repairing, saw mills, sash and door factories, dressed lumber, agricultural machinery, spokes, wheels, general wood working :	
21 Mills.....	317
<i>Manufacture of Flour :</i>	
33 Mills ; 125 Runs of Stone ; 77½ Rolls....	323
<i>Manufacture of Paper.</i> —Consisting of news paper, wrapping paper, calendered papers, &c. :	
5 Mills ; 55 Engines	578
<i>Manufacture of Woollens.</i> —Consisting of felt works, low woollens, blankets, fancy blankets, suspender web, tweeds, cloths, spin- ning, knitting, &c. :	
12 Mills ; 34 Sets of Cards	910
<i>Manufactures from Iron and Steel.</i> —Consisting of malleable iron works, rolling nail plate and spike rods, tacks, bolts, horse nails, found- ries, machine shops, files, nails, spikes, car wheels, axes, saws, augers, bells, shovels, wire staples, hammers, edge tools, handled agricultural implements, knives for mowing and reap- ing machines, marine engines, &c. :	
24 Mills.....	1,494
<i>Manufactures of Cotton :</i>	
5 Mills ; 152,240 Spindles ; 3,725 Looms...	3,535
<i>Miscellaneous Industries.</i> —Such as granite and marble dressing, manu- facture of paints, roofing material, plaster, rope, linseed oil, spice, rice, leather board, starch, glucose, paper pulp, cement :	
14 Mills.....	550
Grand totals, 115 Mills, employing hands.....	7,757

If the policy is to charge at the present rates for power, the Government should insist upon the best water-wheels, all water-wheels that do not obtain a certain standard of efficiency should be replaced by those approved of by the Government or its Agents. Any new wheels placed upon the canals should be subject to such approval. It should be insisted upon, that lessees erect such head-gates as may place the water always under the control of the officials of the canals, and to keep the same in repairs. That when any leakage in flumes, penstocks, or wheels occurs, or they are allowed to become out of repair, the water to be closed from the mills at the head-gates, after notification of such repairs being required, followed by neglect to make them. All expenditure for mills or supplying water to the mills should be borne by the lessees themselves, either the Government making the expenditure and charging the interest upon outlay, repairs, and maintenance, or the lessees making such expenditure under the approval and supervision of the officers of the Government.

If it be decided to raise the hydraulic rents and obtain their present value, making them a source of revenue, the cost of power would be such that the Government would not require to take cognizance of the water after it leaves the canal. Poor wheels, waste of water, &c., would not affect the revenue obtained, if lessees pay the value for the water, it is immaterial and not the concern of the Government what is done with it. So much water is owned by lessees, they can do what they please with it, so long as it does not interfere with navigation or injure the canal proper.

A system depends
upon the policy
adopted.

VALS.

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In such case, lessees would be dealt with in the same manner as those under private water-power companies described in one of the foregoing reports. They become a recognized attendant upon a navigable canal, with rights, status, and importance, in a minor degree to navigation. Expenditure, in this case, should be made by the Government, to improve the supply of water and to render it as constant and invariable as possible. The water should be delivered by the Government, at its own expense, into the raceways of lessees, at such a distance from the line of water in the canals as circumstances would require. Structures for controlling the water, measuring, and all other appliances, necessary for protecting navigation, should, under these conditions, be built by the Government. Its value is obtained for the amount of power now used, without reference to the additional power furnished by the enlargement, there should be, at least, a revenue of \$100,000, for which some \$21,000 is now received.

The most important feature of new leases, or system, is the specification of the volume of water to be drawn for power, and the head under which it is to be utilized. If a certain number of horse-powers be leased, each horse-power to be 75 per cent. of the theoretical power of the water, and to be a specified number of cubic feet per second, at a stated head; a lease containing this specification, with a general clause empowering the Government to supply, regulate, and measure the water for power, and impose such conditions for its effective utilization and the protection of navigation, with other engineering details as at any time may be deemed necessary; such a lease, in an engineering point, would be all that was required. A lease should be drawn up for submission to the law officers of the Crown, and all leases made in the interval of the adoption of a new system, should be of a form that would be adaptable to it, if no decided action is taken upon all the leases in operation.

A means of re-arranging the leasing of hydraulic power upon the canals may be suggested; the practicability or possibility of which it is not my province to judge. There could not be any doubts of its effectiveness.

By legislative action, or an Act of Parliament, cancel all the existing leases of water-power. Such summary legislative action would not be any arbitrary interference with the rights of lessees, as they would receive, under the new leases, all they were entitled to under the old, with the exception of readjustment of rents, which the majority of leases provides for. The new form of lease would be drawn up with no more stringent regulations, in a legal point of view, or with greater scientific precision, as to the method of supplying, measuring, and controlling the water for mill purposes, than is set forth in the leases of private water-power companies. Such a lease could not be objectionable to a party, on a navigable canal not constructed for water-power and paying a much less rental.

Action might be taken on the grounds:—

First. The present form of lease is loose, indefinite, and not adaptable to any satisfactory systematizing of the leasing of water-power on either a business or scientific basis.

Second. That some two-thirds of the leases require renewal.

Third. That in the majority of these leases the rental is higher than later leases which have some time to run, before their term expires. That by the provisions for the readjustment of rent, in the leases, it would be a hardship or injustice to establish a higher rental than the later leases have been granted for. For example, the term of two leases, of A. Buntin, Esq., on the Beauharnois Canal, has expired: rent has been paid at the rate of nearly \$5.00 per horse-power per annum, for 26 years; he manufactures paper of the same class, and in direct competition with John Riordon, Esq., upon the Welland Canal, who has two leases, one 8 years, and the other 18 years to run, which gives him power at 50 cents per horse-power, or one tenth the amount. On what equitable principle can the rent for another term be fixed in the case of Mr. Buntin? Other instances of a similar character, on the same canal, could be cited.

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Fourth. That the enlargement of the canals has necessitated some action of this kind. The increased supply of water for mill purposes, the changed conditions from the time the original instruments were granted, render it difficult for the Government to deal with this increase, with these in operation.

Fifth. There are three monopolies at one or several locks, where the power is subleased to the profit of individuals, a system that successive engineers, who have been connected with the canals, have strongly reported against. To enable the Government to deal successfully with the increased water supply, and dispossess from the control of middlemen, the property of the country, renders necessary the annulment of the leases under which, has been assumed, control of the water-power at St. Gabriel Lock, Côte St. Paul Lock, Lachine Canal, and the lease of the St. Catharines Water-Power Company. Private manufacturers, to whom have been leased the total power at several locks, to prevent claims for any increased power, provided at these locks, would require more definite instruments to be drawn up.

Sixth. A general reform would enable all arrearages of rent, which it is impossible to collect, to be written off the books and the collection, or settlement, of that collectible, before new leases are granted. Under these circumstances, there would not be detailed, year after year, in the Reports of the Inland Revenue Department, the large amount of arrears supposed to be due to the country, and uncollected, which may be said, not to be indicative of sound business, or administrative principles.

Seventh. If action were taken, the term of the new leases could all date from the same period; at the expiration of each term the rents, for the water-power upon the canals whether its value has, in the interval, decreased or increased, could be re-adjusted on a satisfactory basis both for lessee and lessor. Leases granted in the interval of a term might be granted for the unexpired portion of the term, and become subject to the general readjustment and revision, with the other leases. The term of lease might be shortened to 10 years, which would permit the lessee or the Government taking advantage of the variations in the value of power, either through the changes of commercial policy in this country or the United States, or from other causes.

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WELLAND CANAL.

TABLES of water wheels, approximate discharges of water, horse-powers used, and other information with regard to the manner in which the water, drawn from the Canal for hydraulic power, is utilized. Also the names of Lessees, Sub-Lessees or Occupants, situation of mills, date of Lease, power leased, rental paid, and description and list of the machinery in the various manufactories.

WELLAND

TABLE of Water Wheels, approximate discharge of Water and Number of Horse-Hydraulic

Name of Lessee.	Name of Sub-Lessee or Occupant.	Situation of Mill.	Date of Lease.	Term of Lease—Years.	Description of Mill.	No. of Runs or Saws Leased.	Rent.	Description of Machinery in Mill.	No. of Hands Employed.
Robt. Laurie & Co.	R. & J. Laurie.	Port Dalhousie.	Jan. 1, 1851.	21	Flour Mill ...	3 runs...	\$ cts. 197 30	2 runs and machinery.	2
R. & J. Laurie.	Sylvester Neelon.	do ...	Dec. 27, 1851.	21	do ...	4 runs...	240 00	4 runs and machinery.	15
Jno. L. Ranney.	Welland Vale Manufacturing Co.	Levels Nos. 1 to 2.	Jan. 1, 1851.	21	Handle Agricultural Implements	6 runs...	260 00	Trip-hammers, presses, saws, planes, grindstones, &c.	135
Cal. Phelps.	Sylvester Neelon.	Hydraulic Race.	do	21	Flour Mill ...	6 runs...	150 00	7 runs, smut mills, bolts, separators, elevators, &c	40
do	Abell, sub-leased from Neelon.	do	.....	.....	Machine Shop and Foundry.	.....	.....	Lathes, drills, planes, fan furnace and foundry.	6
Richard Collier.	Whitman & Barnes' Manufacturing Co.	Levels Nos. 4 to 5.	Jan. 1, 1851.	21	Knife Works	2 uprig't saws.	167 67	Extension (building) of Knife Works on S. E. cor. W. P. Co.'s Lease.	.....
Thos. Towers	W. B. Smith	Levels Nos. 9 to 10.	do	21	Flour Mill...	2 runs and corn crusher.	140 00	2 runs, 1 smut machine, 1 purifier, 1 separator, 1 sets rolls, elevators, &c	4
No lease granted.	Lincoln Paper Mills.	Hydraulic Race, near Lock 11.	.....	.....	Paper Mill...	.....	100 00	1 60-in. double cylinder, 6 800 lb. engines, 1 Brightman engine, 2 bag machines, 2 flour-sack machines, 2 bottomers, 2 print presses, &c.	50

WELLAND
of Horse-
Hydraulic

CANAL.

powers Used, Dimensions of Flumes, &c., and Machinery in the Mills of the various Lessees.

Description of Machinery Employed.	No. of Hands Employed.	Description of Wheels in Use.					Head.		Water Discharged and Power.		Dimensions of Flume.		Dimensions of Penstock.		Dimensions of Tail Race.			
		Maker.	Name.	Number.	Size in Diameter.	Sq. Inches of Vent or Gate on Wheel.	Head acting on Wheel.	Head available between Levels.	Cub. Ft. of Water discharged per Second.	Horse-power, at 75 p.c. for useful effect.	Horse-power Leased at 75 p.c. for useful effect.	Width.	Depth.	Length.	Width.	Depth.	Width.	Depth below Wheel.
and ma- y.	2	Wilson, Dundas...	Tyler	2	48	320	11 0	10 0	67	57	30	5 0	6 6	12 0	5 0	13 0	6 0	2 0
and ma- y.	15	Paxton, Tait & Co., Port Perry.	Leffel's	2	48	.....	11 6	10 0	91									
		Wilson & Co., Picton.	Little Giant	1	33	.....	11 6	10 0	43	113	40	9 6	7 7	17 6	9 6	12 6	.....	0 10
nmers, saws, grind- &c.	135	A. W. Cole, Oswego.	Sampson.....	1	60	360	9 6	9 6										
		do do ...	New Dominion.	1	54	540	9 6	9 6										
		Slayter's.....	Centre discharge.	1	60	350	9 6	9 6	208	168	60	22 0	7 3	51 0	13 0	12 6	30 0	1 6
smut bolts, rators, ors, &c	40	.....	Overshot	1	18 x 11 ft 6 in.	720	2 6	22 0	.....	.....	60	9 0	2 6					
		do		1	14 x 11 ft 6 in.	600	2 6	22 0	70	130	.....	9 0	2 6					
drills, fan e and y.	6	Barber & Harris, Meaford.	Turbineclass	1	16	48	18 0	.....	7	10	.....	3 0	2 6	4 0	4 0	18 6	.....	1 3
sion (ing) of Works 3. cor. Co.'s	.....	Wilson & Co., Picton.	Little Giant.	1	33	.....	12 0	12 6	47	47	25	6 4	6 0	14 0	10 0	17 6	7 0	1 0
smut ine, fier, 1 rator, rolls, ors, &c ouble 6 800 nes, 1 an en- bag s, 2 kma- 2 bot- s, 2 resses,	4	Wilson, Dundas...	Slayter's Centre discharge.	1	36	336	11 6	12 3	38	37	22	6 0	5 6	8 6	8 6	12 0	.....	1 6
	50	McGill Manufacturing Co., Oshawa.	Leffel	1	56	.....	14 6	.....	93	.....	.....	8 9	13 4	28 0	8 9	18 0	.....	4 0
		Goldie & McCulloch, Galt.	Archimedean.	1	30	.....	14 6	.....	23	143								

WELLAND

TABLE of Water Wheels, approximate discharge of Water and Number

Name of Lessee.	Name of Sub-Lessee or Occupant.	Situation of Mill.	Date of Lease.	Term of Lease—Years.	Description of Mill.	No. of Runs or Saws Leased.	Rent.	Description of Machinery in Mill.	No. of Hands Employed.
Gordon & McKay.	Gordon & McKay.	Lock No. 15.	July 1, 1881.	21	Cotton Factory.	Water at Locks Nos. 12, 13 and 14.	\$ cts. 240 00	11,400 spindles, looms, &c.	235
King & Dolan.	King & Dolan.	Levels Nos. 14 to 15.	July 1, 1882.	21	do	100 H.P.	400 00	300 looms, 12,000 spindles.	250
Jas. Wilson.	Jas. Wilson.	Water from flume, Level 15.	Aug. 8, 1881.	21	Foundry and Machine Shop.	25 H.P., at \$6 per H.P. to 10 H.P., and \$5 per H.P. to 25 H.P.	42 00	Lathes, planers, drills, fans, saws.	.....
Jno. Riordon	Jno. Riordon	Between Locks 17 & 21.	Feb. 21, 1871, & Oct. 1, 1879.	21	Paper Mill...	Water at Locks Nos. 16, 17, 18, 19 and 21.	440 00	Eleven 500 lbs. and four 800 lbs. engines; one 72 in. and one 90 inch Fourdrinier; one 68 in. cylinder and other appliances for manufacturing news and wrapping paper.	150
W. Beatty...	McCleary & McLean.	Levels 20 to 21.	Jan. 1, 1851.	21	Saw Mill	1 upright saw.	108 00	1 upright, 1 circular and 1 slab saw, edger, 1 rip saw, &c.	12
A. Dobbie...	Dobbie & Stewart.	Levels 21 to 22.	From 1st Jan'y, 1865. No lease rent p'd	...	Machine Shop.	1 run...	80 00	4 lathes, 2 planers, 1 drill, 1 circular saw, 1 band saw & 1 wood lathe.	16
W. Beatty...	R.B. McPherson.	do	Jan. 1, 1851.	21	Woollen Factory.	Water for 10 H.P.	63 00	2 sets cards, 4 spinning mills knitting machine, winders, pickers & 1020 spindles.	70

WELLAND
d Number

CANAL.

of Horse-powers Used, Dimensions of Flumes, &c.—Continued.

Description of Machinery.	No. of Hands Employed.	Description of Wheels in Use.				Head.		Water Discharged and Power.		Dimensions of Flume.		Dimensions of Penstock.		Dimensions of Tail Race.			
		Maker.	Name.	Number.	Size in Diameter. Sq. Inches of Vent or Gate on Wheel.	Head acting on Wheel.	Head available between Levels.	Cub. Ft. of Water discharged per Second.	Horse-power, at 75 p. c. for useful effect.	Horse-power leased at 75 p. c. for useful effect.	Width.	Depth.	Length.	Width.	Depth.	Width.	Depth below Wheel.
Spindles, &c.	235		Leffel Jonval	1 1	52 42 405	18 0 18 0	..... .....	80 57 209	..... .....	..... .....	7 6 8 6	10 0	12 0	17 6	.....	6 0	
Spindles.	250	Stilwell & Bierce, Manufacturing Co., Dayton, O., U.S.	Victor..... do	2 1	41 35	12 0 12 0	..... .....	..... 275 280	100								
plan- drills, saws.	.....		Leffel	1	18 12 0	12 0 12 0	..... .....	7 7									
500 lbs. four 800 engines; 2 in. and 90 inch drinier; 8 in. cy- der and appli- for ma- cturing s and ping pa-	150	Holyoke Manufac- turing Co. do Joseph Hall Manu- facturing Co. do do Stout, Mills & Co., Dayton, O. do Joseph Hall Manu- facturing Co. do do	Risdon do Leffel do do American ... do Leffel do do	1 1 1 1 1 1 1 1 1	50 43 74 74 35 30 20 30 74	22 0 27 6 22 0 27 6 14 9 14 4 15 0 14 0 15 0 14 0 15 0 14 0 15 0 14 0 14 6 12 3 14 6 12 3	73 135 57 106 159 200 159 200 30 35 18 21 8 9 20 20 147 147	 159 200 159 200 30 35 18 21 8 9 20 20 147 147	 159 200 159 200 30 35 18 21 8 9 20 20 147 147	12 0 6 6 11 6 6 0 10 6 5 6 10 6 5 6 10 0 5 6 10 0 5 6 10 0 5 6 10 0 5 6 10 0 5 6	6 6 6 0 5 6 5 6 5 6 5 6 5 6 5 6 5 6	..... ..... ..... ..... ..... ..... ..... ..... .....	..... ..... ..... ..... ..... ..... ..... ..... .....	20 0 3 6			
right, 1 lar and 1 saw, ed- rip saw,	12	Dobbie, Thorold... Unknown To be put in.	Butterfly tur- bine class. do	1 1 1	48 720 42 576 36	15 0 14 0 15 0 14 0 15 0 14 0	 162 192 15 12	 15 12	..... ..... .....	8 0 6 0 8 0 9 6 15 6 8 0 2 6	8 0 6 0 8 0 9 6 15 6 8 0 2 6	8 0 9 6 15 6 8 0 2 6	8 0 9 6 15 6 8 0 2 6	8 0 9 6 15 6 8 0 2 6	8 0 9 6 15 6 8 0 2 6	8 0 9 6 15 6 8 0 2 6	8 0 9 6 15 6 8 0 2 6
es, 2 pla- 1 drill, ularsaw, nd saw & od lathe.	16	Stout, Mills & Co.	American ...	1	54 10 0 13 6	10 0 13 6 10 0 13 6	..... .....	65 55 10	..... .....	5 0 4 9 5 0 5 0 10 0 6 0 1 6	4 9 5 0 5 0 10 0 6 0 1 6	5 0 5 0 10 0 6 0 1 6	5 0 5 0 10 0 6 0 1 6	5 0 5 0 10 0 6 0 1 6	5 0 5 0 10 0 6 0 1 6	5 0 5 0 10 0 6 0 1 6	5 0 5 0 10 0 6 0 1 6
cards, 4 ingmills ing ma- e, wind- pickers & spindles.	70	Paxton, Tait & Co., Port Perry.	Leffel	1	48 13 0 13 6	13 0 13 6 13 0 13 6	..... .....	52 57 10	..... .....	9 0 4 6 12 0 6 0 13 6 7 6 1 6	4 6 12 0 6 0 13 6 7 6 1 6	12 0 6 0 13 6 7 6 1 6	6 0 13 6 7 6 1 6	6 0 13 6 7 6 1 6	6 0 13 6 7 6 1 6	6 0 13 6 7 6 1 6	6 0 13 6 7 6 1 6

WELLAND

TABLE of Water Wheels, approximate discharge of Water, Number

Name of Lessee.	Name of Sub-Lessee or Occupant.	Situation of Mill.	Date of Lease.	Term of Lease—Years.	Description of Mill.	No. of Runs or Saws Leased.	Rent.	Description of Machinery in Mill.	No. of Hands Employed.
W. H. Ward. (2 leases.)	John McDonough.	Levels 22 to 23.	Jan. 1, 1851.	21	Saw Mill....	3 circular saws 2 lathes, 2 planing machines & 2 upright saws.	\$ cts. 196 00	1 circular, 1 edging, 1 slabbing and trimming and 2 upright saws.	15
McPherson & Weir.	David Cooper & Son.	do ..	Apr. 17, 1868.	21	Flour Mill...	2 runs..	110 00	2 runs, bolts, purifier, &c.	3
Brown & Ross	Jas. Norris..	Levels 23 to 24.	Jan. 1, 1851.	21	Flour Mill...	3 runs..	180 00	3 runs, 2 bolts, 1 separator, 1 smut machine, 2 purifiers, 1 bran-duster, 2 flour-packers, and elevator.	6
Peleg Howland.	Howland & Co.	do ...	Oct. 24, 1871.	21	do ...	4 runs..	222 10	6 runs, 1 pony run, and 1 set rolls, purifiers, bolts, separators, bran-dusters, smut machines, &c.	20
John Battle.	Thorold Wood Pulp Co.	Levels 24 to 25.	Feb. 11, 1880.	21	Paper Pulp.	2 runs..	120 00	2 emery grinders or pulping engine, Cleveland engine, saws, pumps, screws, &c.	9
Geo. Keefer, sen.	Jas. Lawson	Level 24	Oct. 26, 1825, Nov. 13, 1845, and Lawson 1868.	Perpetual.	Flour Mill...	4 runs..	Free	4 runs, bolts, purifiers, separators, packers, dusters, smutters, elevators, &c.	12
John Battle.	John Battle.	Levels 24 to 25.	July 8, 1879.	21	Cement Mills	1 run....	80 00	2 runs, elevators, conveyors and crack-er.	35
Bond, Elliott & Coleman	John Gill....	Port Robinson.	June 1, 1881.	21	Flour Mill...	3 runs..	206 00	1 run, 1 chop run and machine.	2
							3742 67		1087

WELLAND
er, Number

CANAL.

of Horse-powers Used, Dimensions of Flumes, &c.—*Concluded.*

Description of Machinery in Mill.	No. of Hands Employed.	Description of Wheels in Use.				Head.		Water Discharged and Power.		Dimensions of Flume.		Dimensions of Penstock.		Dimensions of Tail Race.					
		Maker.	Name.	Number.	Size in Diameter. Sq. Inches of Vent or Gate on Wheel.	Head acting on Wheel.	Head available between Levels.	Cub. Ft. of Water discharged per Second.	Horse-power, at 75 p.c. for useful effect.	Horse-power Leased at 75 p.c. for useful effect.	Width.	Depth.	Length.	Width.	Depth.	Width.	Depth below Wheel.		
Circular, 1 g, 1 slab- and trim- and 2 ht saws.	15	Dobbie & Stewart, Thorold.	Turbine class.	1	60	581	12 0	12 6											
			do ..	1	48	480	12 0	12 6											
			Wooden bucket, centre discharge.	1	54	216	12 0	12 6											
			do ..	1	24	168	12 0	12 6	166	169	45	12 0	5 9	1 0	5 6	12 0	12 0	0 10	
s, bolts, er, &c.	3	Smith, Lockport...	Turbine class.	1	44	240	11 8	12 6	27	26	20	4 0	5 0	10 0	4 0	12 8	.....	3 0	
2 bolts, erator, 1 machine, ifiers, 1 duster, 2 packers, levator.	6	Stout, Mills & Co., Dayton, O. Goldie & McCulloch, Galt.	American ...	1	48	.....	11 4	12 6	46 0	.....	.....	.....	.....	3 0	7 0	14 0	8 0	1 6	
			Archimede- dean.	1	42	.....	11 4	12 6	3 0	76 0	30 0	7 0	6 0	3 0	7 0	14 0	8 0	1 6	
1 pony nd 1 set purifiers, separa- ran-dus- mut ma- s, &c.	20	Nicholls & Co., Port Hope.	Leffel	2	40	.....	12 0	12 6	70 0										
			do ... do	1	48	.....	12 0	12 6	50 0										
			do ... do	1	26		12 0	12 6	15 0									7 1/2 x 3 1/2 ft	
			Wilson & Co., Pic- ton.	Little Giant.	1	33		12 0	12 6	47 0									
y grind- pulp- e, Cleve- engine, pumps, s, &c.	9	Wilson, Dundas ...	Tyler.	1	48	360	12 0	12 6	42 0	224	40 0	12 0	6 6	34 0	8 6	12 0	.....	1 6	
			Thornton & Ewart, Oshawa.	Leffel	1	72		10 0		133			14 0	6 0	10 0	14 0	10 0	10 0	3 8
			Wilson & Co., Pic- ton.	Little Giant.	1	33		7 0		36 0	150	20 0							
s, bolts, rs, sep- s, pack- dusters, ers, ele- , &c.	12	Antiquated Wood- en.	Overshot	1	17 x 11 ft 6 in.	480	4 0	21 0	36 0	57 0	40 0	10 6	4 0						
eleva- convey- d crack-	35	Dobbie & Stewart. do ...	Turbine class.	1	60	588	11 0	12	.....	.....	.....	6 6	5 0	10 0	4 9	11 6	6 0	3 4	
			do ...	1	36	504	11 0	12 6	121	112	10 0								
1 chop nd ma-	2	Wooden.	Centre dis- charge.	2	54	312	8 0	.....	29 0	19 0	30 0								
				55							3223								
	1087																		

ST. CATHARINES

TABLE of Water Wheels, approximate discharge of Water, number of Horse-powers of this Company—Rent paid

Name of Lessee.	Name of Sub-Lessee or Occupant.	Situation of Mill.	Date of Lease.	Term of Lease—Years.	Description of Mill.	No. of Runs or Saws Leased.	Description of Machinery in Mill.	No. of Hands Employed.	Description of Maker.
			1851.						
W. H. Merritt & others.	Jas. Shickluna.	Levels Nos. 2 to 3.	May 14	...	Saw mill.....	...	1 upright and 1 circular saw, planing and drilling machines.	6	Unknown Dobbie & Stewart, Thorold. Unknown
do ...	Whitman & Barnes Manufacturing Co.	Levels Nos. 5 to 6.	do 14	...	Can'da Knife Works.	...	Grindstones, punches, dies, polishing wheels, shears and iron working appliances.	80	Wilson & Co., Picton
do ...	McDonald, Jones & Co.	Levels Nos. 6 to 7.	do 14	...	Pulp and Paper Co.	...	6 engines, 2 paper machines, and 3 boilers.	28	Jos. Hall & Co., Oshawa. Wilson & Co., Picton
do ...	N. & O. J. Phelps.	Levels Nos. 7 to 8.	do 14	...	Saw Mill.....	...	Re-building—circular saws, edges, planes, &c.	20	Joseph Hall & Co., Oshawa. Unknown
do ...	Barber & Co.	Levels Nos. 8 to 9	do 14	...	Knitting Factory.	...	1 set cards, 1 jack, 4 knitting frames, 1 winder, &c.	30	Unknown
do ...	P. & J. Phelps	Levels Nos. 9 to 10.	do 14	...	Hammer Works.	...	Trip hammers, presses, grindstones, &c., &c.	18	Wilson & Co., Picton
do ...	H. Paterson & Co.	Levels Nos. 10 to 11.	do 14	...	Canada Wheel Works.	...	Saws, turning and bending machines, planes, &c.	35	Joseph Hall & Co., Oshawa.
do ...	Jas. Norris.	Hydraulic Race.	do 14	21	Welland Canal—Two Flour Mills—Mill No. 1.	...	29 sets rolls, 9 purifiers, 2 smut machines, 2 separators, 7 bolting chests (27 reels in each), 2 bran dusters, 3 dusters, elevators, &c.	20	Stout, Mills & Temple, Dayton, O., U.S. Cole, Oswego, N.Y.

used, dimensions of Flumes, &c., and Machinery used in the Mills of the Sub-Lessees by the Company, \$500 per annum.

[illegible]

ST. CATHARINES

TABLE of Water Wheels, approximate discharge of Water, number

[illegible]

of Horse-powers used, dimensions of Flumes, &c.—Continued.

[illegible]

WELLAND
d Number
the Feeder

CANAL.

of Horse-powers Used, and Machinery in the Mills of the various
and Grand River at Dunnville.

Description
of Machinery
in Mill.

runs and ma-
chinery.

circular saw...
sawing machine
and cross saw.

circular saw...

runs and ma-
chinery.

runs, &c.....
set cards, 3
ooms, 144 spin-
dles, &c.

circular, 1
shingle, 1 slab
saw, and 1 lath
machine.

runs.....

do

Description of Wheels in Use.					Head		Water Dis- charged and Power			Remarks.
Maker.	Name.	Number.	Size in Diameter.	Sq. inches of Vent or Gate on Wheel.	Head acting on Wheel.	Head available between Levels.	Cub. Ft. of Water dis- charged per Second.	Horse-power, at 75 p.c. for useful effect.	Horse-power Leased at 75 p.c. for useful effect.	
			in		ft in	ft in				
Wooden	Central dis- charge.	1	66	312	7 0	.....	.....	.....	.....	Flumes, &c., in bad condition ; wheels poorest description and waste water.
do	do ...	1	72	312	7 0	.....	.....	.....	.....	
do	do ...	1	84	312	7 0	.....	.....	.....	.....	
do	do ...	1	60	198	7 0	.....	100	60	33	
do	do ...	1	84	640	5 0	.....	48	20	23	Flumes, &c., in bad condition ; wheels waste water and of the worst description.
do	do ...	3	60	900	6 0	8 0	75	38	50	
Goldie & McCul- loch.	Archimede- dean.	1	48	.....	7 0	8 0	35	20	20	Wheel does not require full gate to run machinery.
Wooden	Central dis- charge.	1	60	648	8 0	8 0	62	42	15	Wheel of most primitive descrip- tion, and waste water.
do	Bucket Re- action.	1	72	480	6 6	8 0	.....	.....	.....	Wheels inefficient, and waste water.
do	do ...	1	42	150	6 6	8 0	53	30	33	
.....	Iron Re- action.	1	60	360	7 6	.....	33	21	.....	Wheel poor and wastes water.
Wooden	Centre dis- charge.	1	60	504	6 0	.....	42	22	10	
Wilson & Co., Pic- ton.	Little Giant.	1	44	.....	7 0	.....	.....	.....	.....	
do ...	do ...	1	33	.....	7 0	.....	72	42	30	
		16					295	215		

WELLAND

STATEMENT showing the various Descriptions of Machinery at present in
and Races, Consumption of Water and Amount

Where Situated.	Mill Owner.	Description of Mill.	Number of Saws or Run of Stones.	No. of Wheels.	Description of Wheel.	Diameter of Wheel.	Breadth.
						ft. in.	ft.
Dunnville, west side of river.	Beard & Johnson.....	Grist	1 run stone....	1	Reaction..	5 6	.....
do do ..	do do	Saw	1 saw.....	1	Percussion	3 0	.....
West side of dam	R. McDonald, occu- pied by Philps.	do	2 saws	2	do	3 0	.....
East side of river.....	A. Thompson.....	Flour....	3 runs stone ..	3	Reaction..	5 6	.....
East of new flume.....	Chisholm & Minor....	Saw.....	2 saws	2	Percussion	3 0	.....
do	do do ..	do	1 saw.....	1	do	3 0	.....
Adjoining Chisholm & Co. single mill.	Weatherby.....	Fulling..	1 fulling mach.	1	Flutter...	2 6	6
do do ..	do	Carding	2 card do	1	Tub	10 0	.....
Opposite G. Lock.....	H. Davis.....	Saw.....	2 saws.....	2	Percussion	3 0	.....
Adjoining saw mill.....	do	Grist. ...	1 run stone....	1	Reaction..	5 6	.....
At Marshville.....	Board of Works.....	do	1 do	1	Breast	14 0	9
do	do	Saw.....	1 saw.....	1	Flutter	5 6	9
Port Robinson.....	do	Grist	1 run stone....	1	Breast.....	16 0	6
Allanburgh	do	do	2 runs stone....	1	do	13 0	11
do	do	Saw.....	2 saws	2	Flutter	3 0	8
do	do	Carding	2 card mach...	1	Tub	6 6	.....
do	do	Fulling..	1 fulling mill..	1	Flutter	2 6	3
Thorold.....	Geo. Keefer.....	Flour ...	4 runs stone...	1	Overshot .	17 0	11
do	Cowan & Park.....	do	2 do	1	Breast	17 0	5
do	J. Chahoon	Cement. 3	do	1	do	15 0	9
Head of hydraulic race.....	Brown & McDonald..	do .	1 cracker and 2 runs stone.	1	Undershot	16 0	7
Opposite Lock No. 6.....	B. F. Reynolds.....	Turning	Circular saw..	1	Percussion	7 0	5
St. Catharines, hydraulic race.	O. Phelps.....	Flour ..	6 runs stone & fulling mill..	2	Overshot .	{ 18 0 18 0	{ 7 11

WELLAND

present in
Amount

CANAL.

operation on the line of the Welland Canal, with dimensions of Flumes of Rent, &c., &c., 28th January, 1847.

Diameter of Wheel ft. in.	Breadth. ft.	No. Revolutions per Minute.	Head of Water. ft. in.	Issue of Water in inches.	Depth of Flume. ft.	Size of Race.		Rent. £ s	Number of Years' Rent now due.	Remarks.
						Width.	Depth of Water at entrance from Canal. ft.			
5 6	.....	34½	5 6	600	4	8	3	19	50 0	The water should be stopped until the back rent was paid.
3 0	.....	160	5 9	538	4	19	4	19	50 0	
3 0	.....	160	7 6	{ 408 408 }	4	28	4	28	50 0	do do
5 6	.....	45	6 6	{ 340 340 420 }	4	9	6	20	50 0	
3 0	.....	160	8 0	{ 269 269 }	5	30	6	23	50 0	
3 0	.....	160	7 0	538	4	16	5	20	25 0	
2 6	6	.....	5 0	100	5	4	.....	.....	12 10	The water should be stopped until the rent is paid. These mill have been the subject of repeated complaint from Mr. Power.
10 0	.....	.....	5 0	64	5	30	.....	.....	12 10	
3 0	.....	160	7 0	{ 269 538 }	5	30	4	37	62 10	The flume in bad condition and ought to be shut up until the back rent is paid and the flume properly constructed.
5 6	.....	34½	8 0	600	5	6	.....	.....	62 10	
14 0	9	7	2 0	100	4	9	4	.....	30 0	Will be cancelled on adoption of Lake Erie level.
5 6	9	140	7 0	200	4	9	4	.....	30 0	
16 0	6	6	3 0	100	4	5	.....	.....	15 0	
13 0	11	7½	4 0	380	6	4½	.....	.....	15 0	
3 0	8	150	14 0	{ 200 200 }	6	18	3	16	250 0	
6 6	.....	60	14 0	48	.....	.....	.....	.....	.....	
2 6	3	50	14 0	48	.....	.....	.....	.....	.....	
17 0	11	5	4 0	480	4	8	.....	.....	Free.....	The first mill built on the canal.
17 0	5	6	2 6	270	3	5	.....	.....	50 0	
15 0	9	6½	3 0	100	3	6	.....	.....	.....	
16 0	7	9	9 0	300	4	4	4	4	Free...	This mill must be moved to some other place in order that the race may be shut up.
7 0	5	10	1 0	50	15	27	.....	.....	12 10	
{ 18 0 18 0 }	{ 7½ 11 }	{ 5 }	2 6	{ 336 480 }	3	10	3	10	37 10	

WELLAND

STATEMENT showing the various Descriptions of Machinery at present

Where Situated.	Mill Owner.	Description of Mill.	Number of Saws or Run of Stones.	No. of Wheels.	Description of Wheel.	Diameter of Wheel.	Breadth.
						ft. in.	ft.
On race below Phelps Mill.	J. Gibson.....	W o o l factory	3 card mach. & fulling mill	1	Overshot..	12 0	5
do do	J. Noble.....	Axe factory.	Grindst'ne polishing and turning lathe	1	do ...	12 0	7
do do	T. Towers	Foundry	5 lathes and fan.	1	do ...	12 0	3
do do	Grantham	Flour ...	3 runs stone...	1	do ...	17 0	11
do do	E. G. Adams.....	Tanning	Bark mill.....	1	do ...	10 0	6
do do	Stone Mill.....	Flour...	6 runs stone...	2	do ...	18 0	10
do do	J. Mills.....	P u m p factory	3 lathes boring and pump factory.	1	do ...	18 0	10
do do	Salt Works.....	Salt	Salt pumps, &c.	1	do ...	18 0	3

Similar table to the preceding made 35 years ago ; a comparison of the two will

ST. CATHARINES,
28th January, 1847.

WELLAND
at present

CANAL— *Continued.*

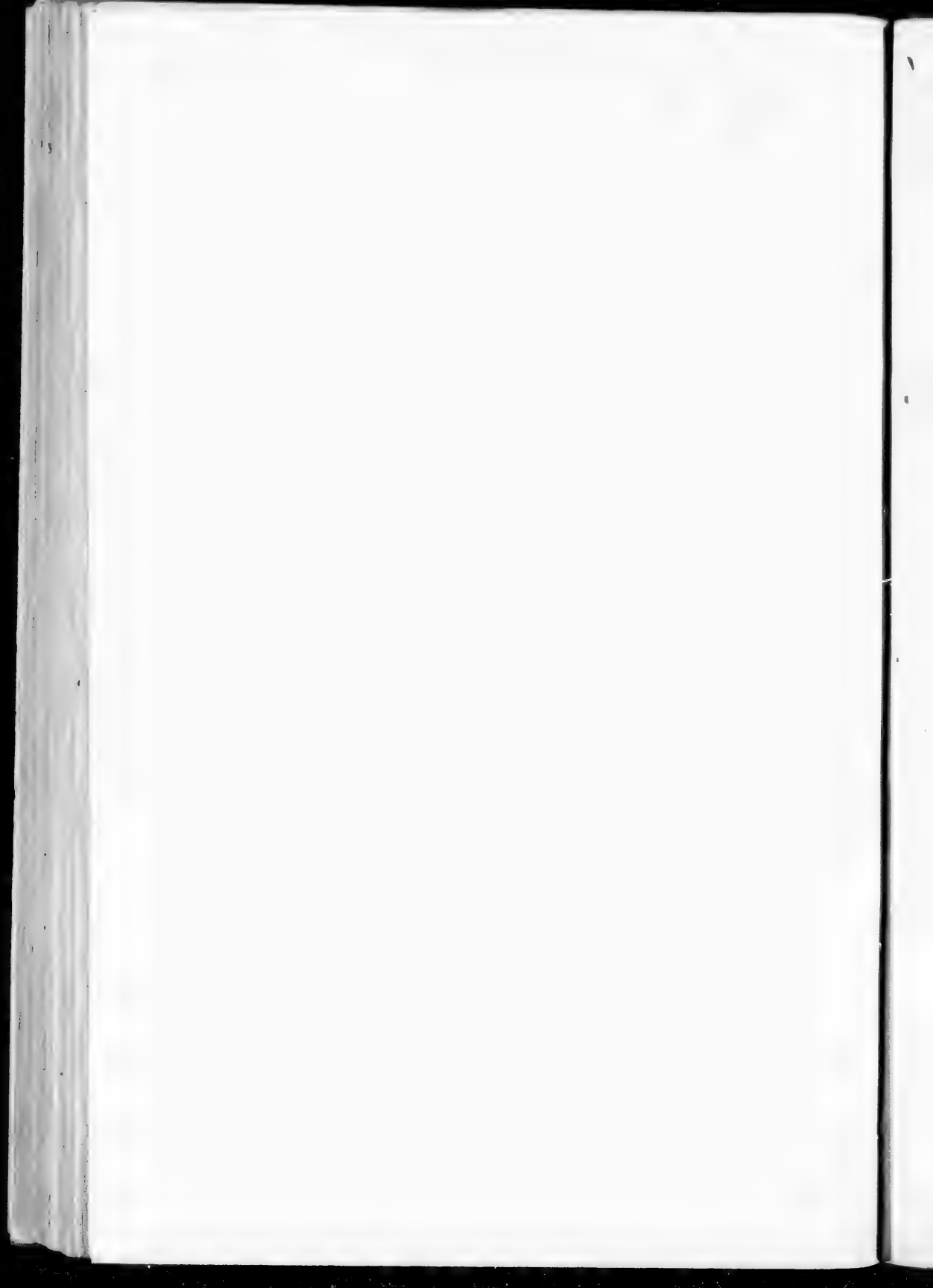
in operation on the line of the Welland Canal, &c.—*Continued.*

Diameter of Wheel.		No. Revolutions per Minute.	Head of Water.	Issue of Water in inches.	Depth of Flume.	Width.	Size of Race.		Rent.	Number of Years' Rent now due.	Remarks.
ft. in.	ft.						Depth of Water at entrance from Canal.	Width.			
12 0	5	9	18 0	36	2 4½	2	4½		£ s.		These operations are carried on under the St. Catharine's Water Power Co. The water used to propel the machinery is taken from the canal at the mountain above Lock 17. It would make no difference to the Water Power Co. to take the supply from Lock 11, and thus avoid 76½ feet of perpendicular fall, and the maintenance of the most expensive portion of the race. A modification of the leases, admitting of this change, should be obtained. See report, page 7.
12 0	7	6	18 0	36	2 7	2	7				
12 0	3	6	18 0	36	2 2	2	2				
17 0	11	5	3 0	300	3 8	3	8				
10 0	6	10	18 0	100	3 6	3	6		125 0		
18 0	10	5	3½ 0	{ 460 570 }	4 8	4	8				
18 0	10	5	2 6	60	4 8	4	8				
18 0	3	5	1 0	30	1						

the two will

show the progress in manufactures upon this canal during the period stated.

(Signed) SAMUEL KEEFER,
Engineer, Welland Canal.



ST. GABRIEL WATER-POWER.

PRIVATE MEMORANDA IN REGARD THERETO.

The lease, of the monopoly of the land and water-power at this Lock, to Messrs. Young & Gould, has caused many difficulties in the past, and every year of its existence is a loss of revenue to the Government. To take decided action renders it necessary, that all the facts, that can be learned with reference to it, be adduced.

The only authority I can find, or the only action, that can be construed into authority for this lease, and the leases on Basin No. 2, executed in 1851, are the following Report and Order in Council, 15th August, 1850.
To His Excellency, &c., &c., &c. :—

"The Commissioners of Public Works, have the honor to report, that by the recent Act, amending the laws relating to the Public Works of this Province, the Commissioners are empowered to take lands, and water, &c., in certain cases, and under the provisions of 9 Vic., Chap. 37, to dispose of the same. And as various applications have been made, for the purchase of property, and the lease of water-power, the Commissioners respectfully recommend, that whatever land adjoining any Lock, or water-power created, by the construction of any Public Work, as the Engineer in charge may deem necessary to set apart for the purpose of erecting machinery thereon, the same shall be purchased at a reasonable rate of compensation, or in case of non-agreement, it be referred to the Provincial Arbitrators.

The Commissioners further recommend, a statement being made of all landed property attached to each respective work, and notice given that tenders will be received from parties for the purchase of the same, on, or before the 1st January next, any such property to be disposed of, under the sanction of His Excellency;—Also the adoption of similar rules and regulations in the sale of water-powers on all the other Public Works as is followed on the Welland Canal."

(Signed) W. H. MERRITT.

Upon this Report was made an Order in Council, No. 1,000, 20th August 1850.

In the Montreal papers of that date, I find two advertisements, dated Department of Public Works, Toronto 3rd October, 1850.

The first has the heading,—“Sale of valuable lands and building lots; the second,—“Hydraulic Lots, &c., for sale.” Tenders or offers would be received for both.

The first advertisement, has the authority of Council, and the sale of the property legal if sanctioned by Council. The second was not authorized by Council, merely the purchase or expropriation of land, necessary for utilizing any water-power created.

These advertisements are continued in the “Montreal Pilot” until 4th January, 1851.

On the 13th January, 1851, another advertisement appears, dated 7th January, 1851, with the heading “Sale of valuable mill sites, &c.” “Notice is hereby given that the hydraulic, and other property, on the line of the Lachine Canal, previously advertised, will be disposed of on the 3rd February next, by auction.”

I find no Order in Council sanctioning the sale of this property by auction, which was considered necessary, to comply with the Act 9 Vic., chap. 37, in the first sale of water-powers upon this canal.

On the 12th December previous, Mr. Young had applied for the whole of the lands and water privileges, at St. Gabriel lock, for an association of individuals “binding themselves to acquire all the lands and make the improvements necessary to utilize the power. The parties with whom I act in this project, are anxious to have the entire control of the water-power of this section of the canal.”

This application was referred to the Engineer of the Board of Works for his report, in which he states:—“It appears very desirable, for the general interests of

the country, to encourage the formation of such companies for the establishment of machinery, and using the water-powers along the line of canals, and it may even be considered advisable to give *preference* to the application of companies over those of individuals, whenever, as in this instance, the company can offer satisfactory evidence as regards their capital and capacity of bringing the whole power into full operation."

As there were several applications of long standing for privileges at this lock, he considers there is no way left, according to the custom of the Department, where there are several applications for a property, but to sell at public auction.

On Mr. Young's application, there is endorsed, "the Commissioners are favorably disposed to the proposition of Mr. Young, but he must bear in mind that there is as much surplus water at this lock, as any other in proportion to the fall, each one of which will doubtless be rented, he must, therefore, govern his offer for the privileges accordingly." (Signed by the Chief Commissioner.) The two points, in this endorsement, are that he was not a good authority, for shortly afterwards he was the applicant for a similar monopoly; and that he intended the full value should be obtained for the property, a fact which will be commented upon hereafter.

On the principle of granting monopolies of water-powers at locks, and the report of the Engineer of the Department thereon, a subsequent Commissioner (Hon. John Young), who ought to be an authority, being himself one of the Lessees of a monopoly, held a contrary opinion to his engineer, and refuses a similar privilege to Mr. Merritt who had previously, when Commissioner, reported in favor of Mr. Young's application.

Office of the Board of Public Works, 19th February, 1852, John Young, Commissioner:—"The Commissioners having also considered the proposition of Mr. Merritt, namely, to dispose of the whole of the hydraulic powers to the intended company..... while they cannot see that there would be greater stimulus given for employment of the water-power, by transferring the entire control to the company as proposed by Mr. Merritt, the Commissioners are of the opinion that it would be highly inexpedient that the Government should cease to have the full and unrestricted control of the water now available, on the line of this important work."

In answer to a letter of Mr. Merritt's, complaining of the action of the Commissioners, they again state, "relative to his complaint of not granting to the company the entire water-power within the hydraulic limits, a due regard for the public interests must prevent the Commissioners from agreeing with Mr. Merritt's proposition."

With regard to the advertisement for sale by auction, previously mentioned, on the 28th January, 1851, it appears with the date of sale changed from the 3rd February to the 12th February.

On the 23rd January, the Secretary of the Department, had written to the Queen's Auctioneer to have the sale of lands, &c., postponed until the 5th February next. The Secretary requests him to draw public attention to the same, to have large placards posted about town at Lachine, and at the church doors.

The mail at that date was some three days going from Toronto to Montreal, the change of date of sale was the result of this letter, the authority for altering the date from the 5th February to the 12th February, does not appear in the records of the Department, as far as I can discover. On the 12th February, 1851, the Assistant Commissioner became Chief Commissioner. I find by a notice in the *Pilot* of that date, and other evidence, that the Chief Commissioner arrived in Montreal on the 11th or 12th February. The sale took place upon the 14th February, a further postponement of two days, for which there was no authority from the Department.

Of previous, and subsequent sales, the Queen's Auctioneer sent official notice of the sale, the names of the parties, and the prices at which they bought. I can find no document of this description.

The only record of this sale is a report of the Chief Commissioner dated Toronto, 17th April, 1851, it was not entered in the record book of letters, or documents, received by the Department, at that date, but was found eleven years afterwards, in

1862; as an important document it was entered at the bottom of a page, corresponding to its date, as No. 13922½.

I find a copy of this report, although not a report to Council, in a book containing these reports. There is a cancelled report, dated 15th April, 1851, No. 1037, and some pages further on another report, dated 24th April, No. 1039, these copies are in the same handwriting. Between these two, in another handwriting, there are copied a report to the Commissioners, dated Jan. 14th, 1851, on the survey of the Rapids of the St. Lawrence, by an Engineer of the Departments, numbered 1038, (this book is devoted to Reports to Council); and the report of this sale as number 1038½, date 17th April, 1851. A portion of the report is written upon the margin. It is evident a number of pages had been left blank for some purpose; a document, which had no place in this book, dated three months previous to the reports, between which it was copied, and which was printed in the Annual Report of the year, inserted to fill the space. There was not room left for the other report, so the margin was made use of, showing it was not copied at its date, but copied subsequent to the 24th April, and it never was a report to Council.

The Chief Commissioner makes the following report, that he has sold and leased upon the Lachine Canal—

Lot No. 1,—Henry Jones & Co.,.....	price	£ 260	0	0
do 2,—W. Murray.....	do	240	0	0
Lots 3, 4, 5, 6,—John Young.....	do	1,140	0	0
do 7, 8, 9, 10,—A. Hooker & L. H. Holton....	do	1,140	0	0
A tract of land north side of Lachine Canal, Cote St. Paul,—P. Turcott,.....	price	868	0	0
All the entire surplus water, disposable, arising and flowing, from the level of the Lachine Canal, at and above the St. Gabriel Lock; and the whole of the land not necessary for canal purposes, near the said Lock, to Messrs. Young & Gould, for the sum of.....				
Lot No. 17,—W. Lyman & Co.,.....	per annum	107	10	0
do 18 & 19,—Grant and Hall,.....	do	215	0	0
do 15,—T. D. Bigelow & Wife.....	do	107	10	0
do 16,—Holland & Dunn,.....	do	107	10	0
do 19—James Harvey,.....	do	27	10	0
do 19,—T. Peck.....	do	27	10	0
Dock & Shipyard, power attached.....	do	251	0	0

Whatever time, and recognition, have done for this sale, at the date it was illegal, and the instruments drawn up, neither the acts of the Department, or Government, from their not having the countersign of the Secretary or the authority of Council. One of these properties sold to Turcot, little was paid upon it, there have been claims for damages from the Government for leakage from the Canal, amounting to considerable sums, the occupant now proposes to sell back to the Government.

Taking into consideration the St. Gabriel Water-Power, and omitting any further reference to the other properties, specified in the report, it is necessary to determine what was actually sold and bought by Messrs. Young & Gould at this Auction, in contradistinction to what was leased by the Commissioner.

The following account of this sale is taken from the *Montreal Gazette* of Feb. 21st 1851.

Sale of Hydraulic and other Lots by the Board of Works.

"The following sale took place on Friday, Mr. Bernard being Auctioneer."

1 Lot on Wellington St., Griffintown, H. Jones & Co.	£260	0	0
3 Lots do do John Young, each	240	0	0
5 Lots do do	300	0	0

5 Mill sites at St. Gabriel Lock, sold in one Lot for 21 years at £420 per annum. There is water on these lots for 20 runs of stones,—Messrs. Gould and others.

1 Lot of ground, a dry dock containing 5 acres 15 perches, for 21 years at £250 per annum,—Mr. Tate.

The farms advertised were not sold."

A newspaper notice may not be legal evidence but when corroborated may have weight. We have therefore these two statements.

"Montreal Gazette,"—5 mill sites and 20 runs of stones at £420 per annum.

Chief Commissioner's Report:—All the entire surplus water, disposable, arising and flowing, and all the land at £420 per annum (or the same price).

This property was advertised to be sold in lots, on 3rd October, 1850, and no changes were made in the advertisements down to the date of the sale.

On the 21st December, 1850, the Engineer of the Board of Works, in his report in favor of Mr. Young's application, stated that the water-power had been laid off in lots but it was necessary for the Commissioners to acquire more land before the whole power could be applied. The price he set on the entire privilege, was £750 per annum. He also states:—"It may be prudent to restrict the sale or leases to five privileges of four runs, equal to twenty runs in all.

The missing report of the Engineer of the Board of Works, which was sent to the Department twelve years after its date, 15th January, 1851, was sent to the Queen's Auctioneer and Mr. Ostell, a surveyor, and engineer, together with plans to lay off the water-privileges at St. Gabriel, and Cote St. Paul, in lots. This report divides the property into five mill privileges and two sites for dry docks. Although the plan of the division into lots at Cote St. Paul, made at the same time, is in the Department, I can find neither plan, or trace copy, of the plan exposed at the date of auction, either in this office, or any place in Montreal. Mr. Ostell was ordered on the 23rd January, to stake out the lots on the plan of the Chief Engineer, he notifies the Department he has done so on the 29th January, 1851, the letter arrives in Toronto on the 4th February, the Chief Commissioner was there at that date, it was referred to the Chief Engineer and no action taken upon it. Mr. Ostell asks,—“should there be any alteration required in the above, or further proceedings necessary, be pleased to let me know as soon as possible, as there are parties constantly seeking information from Mr. Bernard, and myself, as to the limits of privileges.” There seems to have been no intention, at that date, to dispose of the property in the terms of the lease. It was not so sold on the 14th February, 1851, if the account in the *Gazette* is correct, which account is corroborated by the statement of one of the sub-lessees of Messrs. Young & Gould, who was at the sale, with the intention of buying a lot, but when the five lots were put up “en bloc,” he was unable to purchase. He has kindly given me a statement, over his own signature, a copy of which is appended, it may be of value, as he is probably the only gentleman alive, who was at the sale; he also remembers distinctly the manner in which the property was sold by the auctioneer, as 5 mill sites with 20 runs of stones in one lot, there was no reference to the *entire* surplus water or *all* the lands. Attached to this missing report of the Engineer of the Department is an appendix, ostensibly made on the same date as the remainder of the report which states:—"In consequence of its having been intimated, to the Department of Public Works, that certain parties at Montreal are desirous of purchasing the right of using *all* the waste land and surplus water, disposable at the St. Gabriel Lock, it is respectfully submitted, that no objection appears to present itself to carrying out such an arrangement, provided the following conditions, in addition to those already specified for granting the privileges separately, be complied with." "Upset rental for the whole privilege £500, per annum."

The Deputy Commissioner in evidence before Arbitrators, states:—"It was at first proposed to let the St. Gabriel Lots in separate lots, as appears by advertisement dated 3rd October, 1850, on conditions now produced No. 2. Mr. Young then came forward and offered to take the whole. His offer is now produced (No. 3.) dated

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12th December, 1850. This offer was referred to me for report, and I made the report No. 4 now produced. The document produced No. 5, is a report I drew up on the 15th January, 1851, for the purpose of laying the scheme before the public. The conditions were to be seen at the sale."

Document No. 5 was the missing report, we have here the statement that this appendix was written upon the 15th January, 1851, as the conditions, and regulations, with the original view of leasing in separate lots, and the conditions, and regulations of this appendix for leasing the entire surplus water and land, are included in the same document.

It is anomalous that the Secretary of the Department would send all these conditions, and regulations, together with a plan of the property laid out in lots, upon 15th January, 1851, to the Queen's Auctioneer, that on the 23rd January the Secretary should instruct Mr. Ostell to obtain from the Queen's Auctioneer the plan and lay the property out in lots, that he should notify the Department upon the 29th January, of his having done so, that parties should be seeking information, as to the boundaries of the lots, from both the Auctioneer and Mr. Ostell, while at the time, the Department, and the Auctioneer, had in their possession this appendix with conditions, and regulations, for selling, and leasing, all the land and water.

It is evident, from what has been adduced, that this appendix was not written upon the date assigned, nor before the date of sale, at least it was not an official document; and that the property was sold upon the Chief Engineer's report of 21st December, 1850, in which he recommends the sale of 5 mill sites and 20 runs of stones; and not upon this appendix, (a change of opinion in less than a month alleged to have been made on the 15th January, 1851, which says,—“in consequence of it having been intimated to the Department, that certain parties are desirous of purchasing the right of using *all* the waste land, and surplus water,” (the *all* is underlined as if it were necessary to draw special attention, that it was *all*)).

It would be interesting to know the date of this appendix, in an account of Mr. Ostell's, he specifies day and date, for all work done for the Department. From Jan. 31st to February 4th he was surveying, laying out, and picketing off, hydraulic lots, at St. Gabriel, and Cote St. Paul. From 5th February to 12th February he was plotting and making plans of hydraulic lots, at St. Gabriel and Cote St. Paul, consisting of four different plans, making fifteen lots. On 11th February he charges for services with the Commissioner of Public Works, on the day after he finished the plans with the property as laid out, to be exhibited at the auction, showing that the change had not been made at that date. From 22nd February to 27th February, compiling and making out large office plot of part of St. Gabriel, showing the relative position of hydraulic lots, including streets, canal, locks, and various parts about to be conceded to Messrs. Young & Gould, and copy delivered to annex to lease. On the 27th, thirteen days after the date of lease, parts were about to be conceded, the appendix of the missing report had not apparently reached Montreal at that date. This gentleman would have every opportunity to know every thing connected with this transaction, being a connection of the Chief Commissioner, and engaged with him in matters concerning this sale, from February 11th to March 15th, he, as will be shown subsequently, was probably a silent partner in the lease at this date.

The plans of the lots laid out by Mr. Ostell at Cote St. Paul, are in this office, but none can be found of the lots laid out at St. Gabriel at the same time. In the absence of plans, it is not easy to determine the position, positively, of the five mill sites set out. As shown by the following sketch, three were on Government property, and two, the greater part, on land that was to be acquired by the Government. The upset price for these lots was £100 rental per year, the Government to purchase the necessary land. The price for a run of stones was £12 10s, per annum.

As already stated the original plan according to which these lots were laid out, is not to be found; from their description in report of January 15th, 1851; information derived from Mr. Ostell's letter announcing he has laid off the lots, and asking if there is any alteration required; in which there is a

sketch, upon the margin, of three lots; also from a copy of plan, attached to the Notarial instrument, obtained in Montreal, the following sketches are made; the comparison of which will graphically illustrate the difference between what was purchased and what was leased.

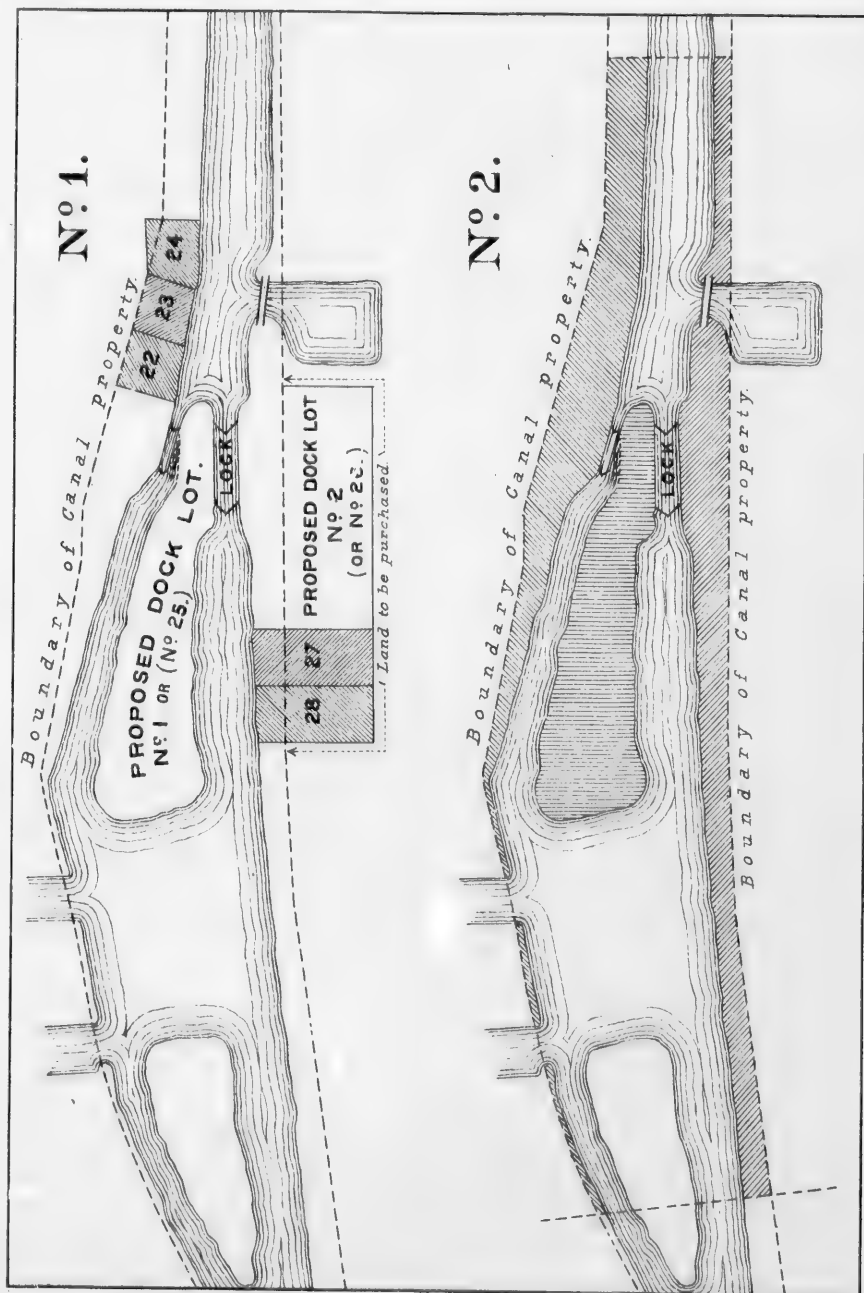
Sketch No. 1, represents the plan supposed to have been exhibited at the sale, with the property laid out according to the plan of the engineer of the Department. Lots Nos. 22, 23, 24 and the parts of Lots Nos. 27 and 28, with twenty runs of stones attached, purchased by Young & Gould.

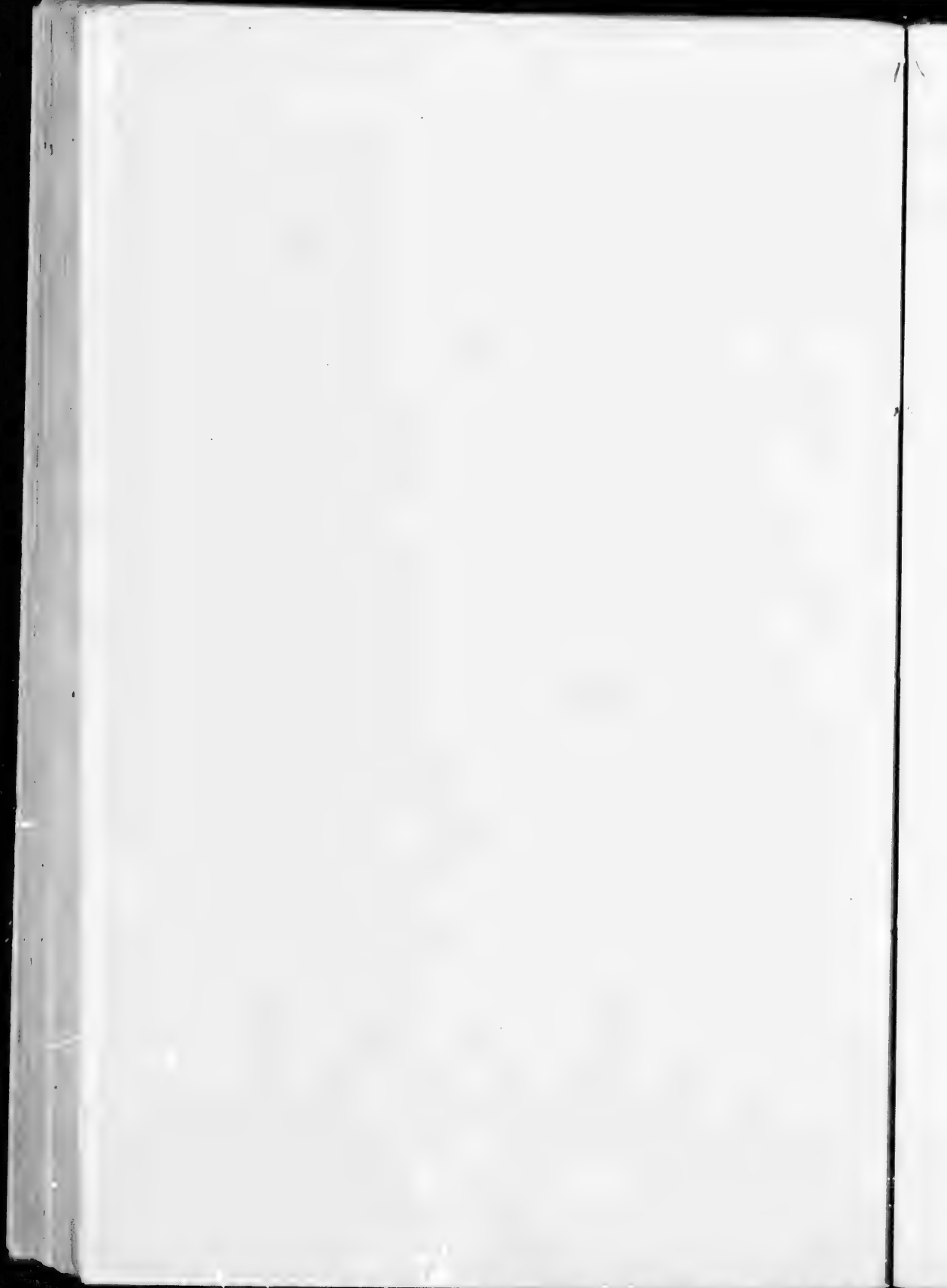
Sketch No. 2.-- Plan attached to Notarial Instrument, leasing all the land, coloured red on plan (cross-hatched in sketch), and all the surplus water.

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On sketch No. 1, Dock Lots Nos. 1 and 2, or Lots Nos. 23 and 24, were laid out for dry docks. The dotted line represents the limit of the canal property. The whole of the land for No. 2 dock lot, and the greater part for the mill lots Nos. 27 and 28, were to have been acquired by the Commissioners of Public Works. The upset price, for these lots, was £100 each, for the mill privileges, and £150 each, for the dock lots, all the lots had four runs of stones attached, or twenty-eight runs in all. The total upset price of this property was £800 rent per annum. If all the lots had been purchased at the sale, the parties purchasing to acquire the land, the rental would have been :—

Three mill sites, land upon Government property, at £100.....	£300 0 0
Two do $\frac{1}{2}$ do do do Ground rent, at £10.....	20 0 0
Eight runs of stones (to the two lots), at £12 10s.....	100 0 0
Total yearly rental... ..	£420 0 0
Dock Lot on Government property.....	150 0 0
Four runs of stones for lot not on Government property.....	50 0 0
Total for the whole privilege.....	£620 0 0

It is strange that if the account of sale, in the *Montreal Gazette*, and the corroborative statement of Mr. Cantin, is incorrect, and the report of sale by the Commissioner correct, that the yearly rental corresponds with the upset value of lots, established by the Board of Works £420 per annum. It is clear that in whatever light this transaction may be viewed, the Government have, during the tenure of this lease, received only the value of five mill sites and twenty runs of stones, and not of *all* the land and water.

That the previous Chief Commissioner, who made the reports to Council, which led up to this leasing, intended to obtain the full value of the privilege, is evident from his endorsement on Mr. Young's application.

Mr. Ostell's in his evidence before arbitrators, October, 1863, states :—" I was present at the original sale of water-power at St. Gabriel lock, full conditions had been prepared by the Government, and the property was to be offered in lots. General conditions were then submitted, to the best of my recollection, identical with those in Exhibit No. 2 (sale by lots 22nd December, 1850). These conditions were afterwards modified, and No. 5 was substituted, when the sale *en bloc* took place, to Messrs. Young & Gould." No. 5 was the missing report with appendix attached, that it was substituted on the 14th February, 1851, the date of sale and the date of lease, does not agree with his account, paid upon the 15th March, 1851, when on the 27th February, he uses the words about to be conceded.

Hon. John Young, at the same time in evidence, states : " I remember the hydraulic privileges advertised, and certain conditions read over by Mr. Bernard, the Auctioneer, at the sale, plans of the property being then produced for inspection." These plans must have been those of the Chief Engineer, and Mr. Ostell, the Surveyor, with the property divided in lots, as he states, he had finished them on February 12th. He had completed only on the 27th February, thirteen days after the sale, the plan annexed to the lease.

There were many applications for mill privileges at this lock, some of which were granted, and afterwards refused, there seemed a deliberate intention of all concerned to firmly establish this monopoly, and the anxiety betrayed to draw attention to the fact that these Lessees were proprietors of all the land and water, shows there must have existed some doubts as to this fact.

On the 5th December, 1850, an official letter grants the privilege of constructing a dry dock, and use of water above St. Gabriel Lock under certain conditions. The application was dated 16th November, 1850, there is endorsed upon it over initials of

the Assistant Commissioner, "the recommendation of Mr. Rubidge cannot be carried out as the entire of the water has been already disposed of to other parties." At the date of this application the Assistant Commissioner was Superintendent of the Welland Canal. He returned to the Department upon the 15th February, 1851. This endorsement was made subsequent to this date, the granting of this privilege was not a recommendation, but a letter addressed to the applicant, and recorded in the books of the Department, previous to the date of this lease.

In 1845 or '46, Mr. A. Cantin applied for a dry dock privilege, with water-power attached, a plan was sent in, showing the proposed improvements, and referred to Mr. Barrett, the Engineer upon the Canal. This plan is upon record in the Department. On the 15th November, 1850, Mr. Cantin writes:—"Seeing you have advertised a piece of land which I made application for five years ago, I want to know if I could get it for the use of making a dry dock."

On the 10th January, 1851, he transmits a plan to the Secretary of the Public Works, and application for this privilege, and trusts it will receive the favorable consideration of the Commissioners. On this application there is an endorsement, erased, made by the Commissioner, and the note ("19th March, 1852, answered") substituted. It was referred to the Engineer of the Department who reports in favor of the application, but to accede to it Mr. Cantin must comply with certain conditions, the first of which is:—"The Commissioners having leased all the water passing around the Lock at St. Gabriel to a company, it will be necessary for him to obtain from that company, the privilege of using all the water he may require both for his mills and dock." In accordance with the directions of the Chief Commissioner an agreement is drawn up by the Chief Engineer and signed by Mr. Cantin on the 10th July, 1851, with above provision on it. Afterwards Mr. Cantin desired that no further action be taken until he writes again upon the subject. Mr. Cantin, was no doubt acquainted with the manner in which the property was leased, for on the 25th October, 1851, permission was given him to construct his proposed works, and an agreement entered into by the Commissioners and Mr. Cantin, in which the clause, compelling him to obtain from Messrs. Young & Gould, the necessary water-power, is omitted.

A copy of this agreement is sent to the Department by Mr. Ostell, on the 8th March, 1852, who writes, Mr. Cantin only awaits their embodiment into a lease to commence the execution of his works. In the mean time one of the Lessees of this water-power had become Commissioner of Public Works. On the 16th March, 1852, Present Hon. John Young and Hon. H. H. Killaly, Commissioners, it is recorded in the minutes of the Board of Works:—"Upon the letter of Mr. Ostell, inclosing a memorandum of agreement which he states to have arranged with A. Cantin (the agreement was between the Commissioners of Public Works and Mr. Cantin), relative to a water privilege at St. Gabriel, state that Young & Gould had leased on the 14th February, 1851, the entire surplus water, that Mr. Cantin's first application was made only upon the 10th and received on the 20th June," 1851.

(The first application, as previously noticed, was made in 1845 or '46, and again in November, 1850, in reference to the advertisement of the Board of Works in October, 1850.) "That Hon. Mr. Bourret had reported 17th April, 1851, that he had leased the whole surplus water to Young & Gould, that the Commissioners find a report of Mr. Keefer of the 30th June, 1851, stating as follows: "The Commissioners having leased all the water-power passing around the Lock at St. Gabriel," and again in a subsequent report of 10th July: "Mr. Cantin must obtain from the Company at St. Gabriel, the privilege of using such water as he may require," and in the same report Mr. Keefer states that: "Mr. Cantin had requested no further action to be taken in the matter until he writes again on the subject," from 10th July to 8th March nothing has been received from Mr. Cantin.

This gentleman had requested that no further action should be taken upon the agreement he had been induced to sign with Mr. Keefer, but on the 25th October, 1851, he had taken such effectual action, that the Commissioners of Public Works, entered into an agreement with him to grant him water for his dock, and a saw mill,

without reference to the lease of Young & Gould. It is, therefore, evident that the minute of the Board of Works is misleading.

Upon the copy of this agreement, submitted to the Commissioners, there is this note over the initials of the Assistant Commissioner:—"When these conditions were submitted to Mr. Killaly he had not been informed, that the whole of the water-power had been previously sold to other parties." What is the effect of this note? The lease to Young & Gould reads:—"Personally appeared, the Honorable Joseph Bourret, of Montreal, Chief Commissioner, and Hon. H. H. Killaly, of Toronto, Assistant Commissioner, as Commissioners of Public Works." This is a legal form, which perhaps only requires the presence of the Chief Commissioner, as his is the only signature attached to the lease. The report of the Chief Commissioner is dated 16th April, 1851, on that date the minutes of the Board of Works, record the transaction of business connected with the Lachine Canal, present the Chief and Assistant Commissioners, no reference is made to this report dated the same day, the peculiarity of its entry among the Reports to Council is noted previously.

We have now the fact, that the Assistant Commissioner on the 25th October did not know the contents of a lease made eight months before, to which he is supposed to be a party; he did not know the contents of this report made six months previously, and on the same date that both Commissioners, being present, transacted business concerning the Lachine Canal. That on the 25th October the Chief Commissioner, and Assistant Commissioner, signed an agreement in violation of the terms of this lease; and the Chief Commissioner, had not, or did not, at the time inform him that he had leased the whole of the water-power.

The Commissioners, at their meeting on the 16th March, previously, referred to, ordered a letter to be written to Mr. Cantin, informing him that all the surplus water had been disposed of, and he must apply to Messrs. Young and Gould for the amount of water required.

As one of the lessees of this power was Commissioner, no further action was taken upon the agreement of the former Commissioners. The result of this business Mr. Cantin bought a run of stones, from one of the lessees at Basin No. 2, which could not be returned into the canal, for his dock. The run was not referred to, in the investigation of the water consumed at Basin No. 2, as it did not make any difference whether one, or four runs, were sold, all the water wanted could be drawn from the canal. The power he required was leased from Young and Gould, eight runs of stones, and a lot of land, for \$800 rental per annum, the water in justice belonging to the Government, or a loss on this transaction of a reveau of \$400 per annum.

The incidents which lead up to, and attendant upon the granting of this lease, as recorded in the Department, having been commented upon, the lease itself will be investigated. A blank form of lease, similar to that in use upon the Welland Canal, had passed through the hands of the Attorney General, and had been printed, adapted for the legal forms of Lower Canada. This blank form was used for this lease, or notarial instrument, deposited in Montreal; to adapt it to the changes, from sale by lots, to the granting of this monopoly, the margins, blanks, and erasures, were used. The erasures and marginal references are numerous, covering all the blank space, and are the most important part of the document. The dates of the other deeds, and leases of property disposed of at that time, extended to the 15th March, this was executed upon the day of sale 14th February, it being the most important, and lengthy, the celerity with which it was drawn up is remarkable. The sale took place at near mid-day, it was quicker work than legal gentlemen usually indulge in, to have a document of that description ready for signature in the same day. Without the sale was a deception, it was drawn up subsequent to its date, or the blank form signed on that date, and the marginal references and erasures made subsequently. That the plan, which is a portion of the lease, ("the said leased premises being bounded as above and shown on the plan hereto annexed, edged in red,") is antedated, is evident, from Mr. Ostell's account, which states that the copy was delivered upon February 27th, to be annexed to the lease. As the parts were about to be con-

ceded upon that date, the lease was made after the plan which would be possible, as it was not entered in the Registrar's books at Montreal until 13th March. The date of a portion of this report of the Chief Engineer's of January, 1850, can be supposed. The marginal references, and erasures, in the lease, are similar to the conditions, and regulations, in this report, and must have been copied from it for in the term "all the waste land" used in the report, and copied in the lease, the word "waste" is erased; the Lessees took care that there should not be any ambiguity to prevent their grasping all the land.

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